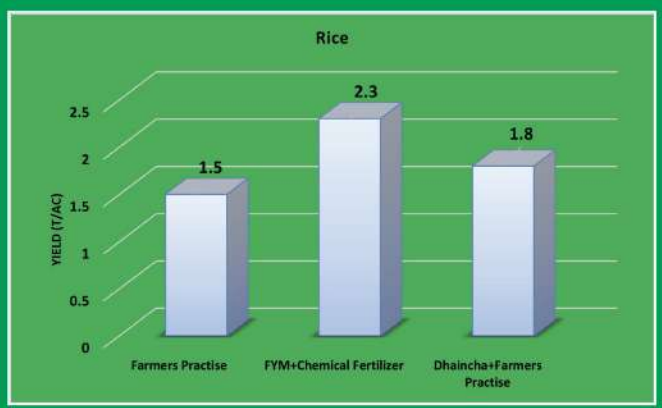
FERTILIZER RECOMMENDATION GUIDE – 2024



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FERTILIZER RECOMMENDATION GUIDE – 2024

NATIONAL SOIL SERVICES CENTRE

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"We must manage our available resources wisely, minimize waste, and ensure that all our resources are directed at improving the well-being of the people and in fulfilling our national vision."

-HM The King Jigme Khesar Namgyel Wangchuck

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FOREWORD

The Fertilizer Recommendation Guide-2024 (FRG-2024) is the third updated version. It includes Dzongkhag-wise fertilizer recommendations for major crops based on present soil fertility information of different Dzongkhags. In addition to the contents of the previous guide, this guide includes fertilizer rates for some of the hybrid crops and updated lime recommendations. Besides, it encapsulates sections on essential soil parameters, integrated plant nutrient management, organic fertilizers, soil sampling, and soil health that are crucial for maintaining improved soil fertility, sustainable soil health management, and crop production. The FRG-2024 has been prepared targeting farmers, extension officials, researchers, agronomists, and private entrepreneurs. Therefore, we are very hopeful that the FRG-2024 will serve its intended purpose and achieve the ultimate goal of balanced and judicious use of plant nutrients for enhanced crop yield while at the same time reduce economic cost and environmental pollution. We sincerely urge our field extension colleagues and researchers to use this Guide and also provide us any feedback or comments for further improvement in future.

PREFACE

The second version of a guide to fertilizer recommendations for major crops was published in 2013. It guided extension staff, farmers, researchers, and others on the types and rates of fertilizer usage on various crops. Since the second version was developed almost a decade ago, there was a need to review the soil fertility status of the Dzongkhags and update the second version. The third version of the Fertilizer Recommendation Guide - 2024 (FRG) was developed based on recent soil data from the Soil Survey Program that was further reviewed with the Soil Fertility Program's database. Furthermore, one of the primary impediments to the adoption of the second version was the inadequate know-how of the extension staff to convert nutrient rates into absolute fertilizer rates for a particular nutrient. Additionally, providing information on fertilizer rates using not only single but compound fertilizer as well has been one of the pertinent issues put forth by the extensions in the field. The third version of the fertilizer recommendation guide, therefore, considered all the feedbacks and suggestions received from the field and attempted to address them for extensive adoption in the field.

The additional information in the third version is Dzongkhag-wise fertilizer recommendations. The fertilizer rate was based on farmer-extension fertilizer use trials (FEFUT) conducted by the National Soil Services Center in different Dzongkhags, yield targets, and the current soil fertility levels. Fertilizer rates for crops with limited or no research conducted, hybrid vegetables, fruit trees, and plantation crops are incorporated as well, and these rates are based on an extensive literature review. This guide also encompasses revised lime requirements for acidic soil amendments.

The optimum fertilizer recommendation for a specific area or location is usually made only after soil sampling and soil analysis at the Soil and Plant Analytical Laboratory (SPAL) of the NSSC. Site-specific fertilizer recommendation is most important to maximize sustainable crop yields and profit. Therefore, regular soil sampling and testing are highly recommended.

1. INTRODUCTION

The nutrients needed by plants are mainly taken from the soil, and proper nutrient management is the key to having a sustainable, high-yielding crop without any damage to the plant, environment, or soil productivity. Even when the operation is organic or conventional, the nutrient requirements should be sufficient to ensure a satisfactory crop yield. Nutrient soil testing and fertilizer application are vital to supplement nutrients needed by crops for more and better-quality food and cash crop production.

Soil samples recently tested by the Soil Survey Program for Soil Atlas development were interpreted for these guidelines, and fertilizer recommendations are mainly based on the soil test levels and yield targets. Furthermore, the fertilizer rates from the fertilizer demonstration trial conducted by the National Soil Services Center have also been revised in line with the recent soil test levels. In the case of some crops, fruit trees, and hybrids, the fertilizer rates from the most widely referred literature are used in these guidelines. The primary purpose of this guide is to provide farmers, extension officials, agronomists, and researchers with the tools to determine fertilizer rates to optimize crop yield and reduce the loss of nutrients to the environment.

1.1 Points to consider while using fertilizer recommendation guidebook

The user should carefully read and follow the guidelines as stated below:

- Read the guide thoroughly to understand the logic and principles of fertilizer application.
- The fertilizer application rate is divided in two categories: option 1 (using single fertilizer) and option 2 (using compound fertilizer).
- The use of organic manure along with chemical fertilizers must be done to improve organic matter and soil structure. The high-intensity rain-vulnerable Dzongkhags should apply more organic fertilizer to improve soil structure and nutrient retention.
- Irrigating the field, post-fertilizer usage is crucial. The soil should be moist, or a light irrigation should be applied post-fertilizer application. The fertilizer that is in granular form fails to dissolve and subsequently releases the nutrients to the crop without irrigation. The fertilizers must be dissolved to release nutrients, or the crop may not get the nutrients at the right time for improved crop productivity.

2. SOIL NUTRIENT STATUS OF BHUTAN

Generally, the soil nutrient status of the Bhutanese soils is poor. The major concerns are a low pH and nitrogen, phosphate status and imbalanced base nutrition. The main features of the soils as indicated by the analytical results are:

- Although the soils are generally acidic with low to medium (pH $\leq$ 5.5) pH, the aluminium toxicity is of limited concern except for some lowland subtropical soils.

- In general, the soil organic matter levels are adequate but total nitrogen (N) levels are low to medium as a result C: N ratios are favourable.
- Available phosphorus (P) is low to medium, and potassium (K) is low in most soils. Low available P is of greater concern as soil parent materials are generally K rich.
- The percent base saturation (BS%) and imbalance between exchangeable bases are of concern. BS% and total exchangeable bases are low or very low in most soils across the country.
- The cation exchange capacity (CEC) is within medium range in most soils.

3. PLANT NUTRIENTS

3.1 Plant nutrient requirements

Crop growth is influenced by a number of factors of which plant nutrient availability is one important factor. There are 16 nutrient elements considered essential for plant growth. Essential elements are usually categorized into three groups as shown in table 1.

Table 1. Essential plant nutrient

Primary Nutrients		Secondary Nutrients	Micronutrients
Carbon (C)	Nitrogen (N)	Calcium (Ca)	Iron (Fe)
Hydrogen (H)	Phosphorus (P)	Magnesium (Mg)	Zinc (Zn)
Oxygen (O)	Potassium (K)	Sulphur (S)	Copper (Cu)
			Boron (B)
			Molybdenum (Mo)
			Chlorine (Cl)
			Manganese (Mn)

- Primary nutrients are required in larger quantities;
- Secondary nutrients are needed in lesser amounts than primary nutrients;
- Micronutrients are required in small quantities; and
- Carbon, hydrogen and oxygen are obtained from air and water while the other thirteen elements are referred to as fertilizer elements and have to be obtained from the soil.

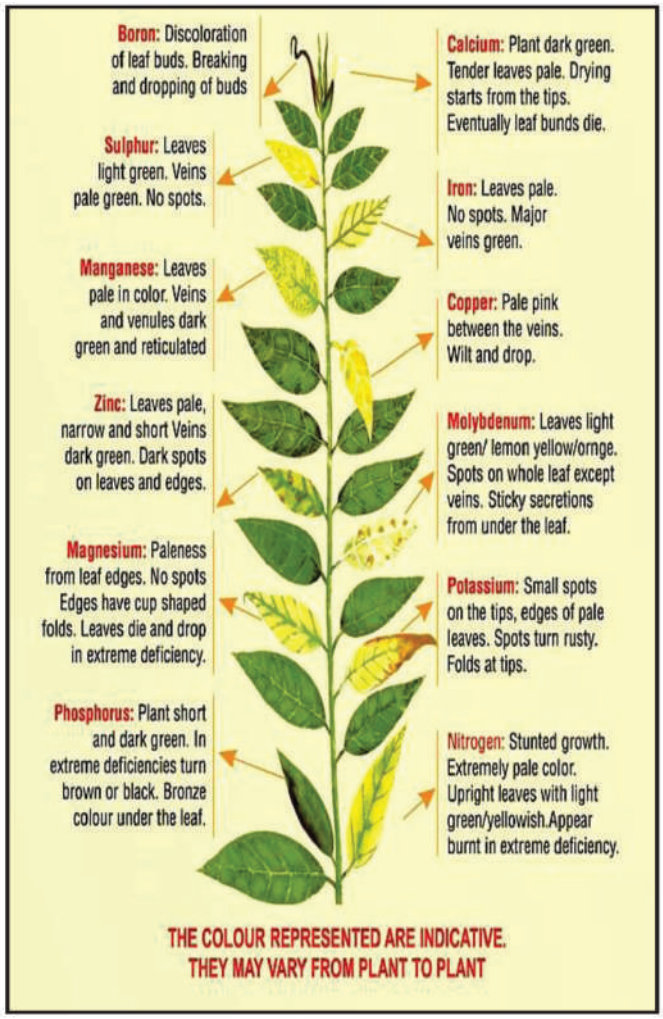
An essential plant nutrient element has the following characteristics:

- It plays a specific role in the plant growth and development.
- In its absence, the completion of the life cycle of the plant cannot be achieved.
- If deficient, it causes a setback to plant growth, and the plant shows visual symptoms of the deficiency.

Table 2. Essential plant nutrients, functions, deficiency, and excess symptoms

Nutrient	Functions	Deficiency Symptoms	Excess Symptoms
Nitrogen (N)	Protein synthesis, effect on growth and quality	Delayed maturity, stunted growth, yellowing of older leaves	Very dark green, succulent, susceptible to disease, and insect infestation, Lodging
Phosphorus (P)	Cell division and the formation of new cells. Early root growth, fruit and seed set	Poor seedling establishment, root development and fruit and seed set. Purple discoloration of older leaves	Looks like Ca. Zn, Fe or Mn deficiency symptoms of leaves
Potassium (K)	Carbohydrate (starch & sugars) and protein synthesis, water balance control. Fruit development	Yellowing of margins and tips of older leaves, progressing to white-brownish spots and then 'scorching' (necrosis) of leaf margins	Shows Mg or K deficiency symptoms of leaves
Calcium (Ca)	Proper functioning of growing points, particularly root tips and fruit development	Pre-mature dropping of buds and blossoms, bending of tips, brown spotting (apples, celery), blossom end rot in tomatoes	Possible Ca or K deficiency symptoms of leaves
Magnesium (Mg)	Involved in photosynthesis, protein synthesis, energy transfer	Interveinal chlorosis/yellowing, mottling, green veins, orange, red or purple discoloration possible, leaves may curl at margins	Premature senescence of leaves
Sulphur (S)	Chlorophyll production, constituent of several amino acids which are essential for proteins	Similar to N deficiency but first in young tissue: light green to yellowish leaves with lighter color veins	Very dark green, succulent, susceptible to disease & insect infestation. lodging, blossom abortion
Boron (B)	Carbohydrate, starch and sugar metabolism	Black/brown heart in leafy plants, cracking and deformation of roots or stalks (corky tissue)	Leaf margins and tips turn brown and die
Copper (Cu)	Constituent of proteins, energy transfer	Plants look bleached and stunted, tip burn in cereals, dieback of leaves in vegetables, die back of twigs in citrus, mottled leaves	Very slow growth shows iron deficiency
Iron (Fe)	Required for photosynthesis, respiration and chlorophyll production	Interveinal chlorosis, leaves become whitish, veins remain green, could be confused with Mg deficiency	Bronzing of leaves with tiny brown spots, blackish rice root
Manganese (Mn)	Chlorophyll production and photosynthesis	Chlorosis, may display lots of small, black/ brown spots	Older leaves show brown spots surrounded by chlorotic zones and circle
Molybdenum (Mo)	Essential for N assimilation, important in legumes for rhizobia function	Legumes show N-deficiency symptoms, brassicas produce long, narrow, deformed leaves	Chlorotic young leaves, purple in tomatoes, stunted growth

Figure 1. Visual symptoms of nutrient deficiency



Source: http://apfl.in/Deficiency

4. IMPORTANT SOIL PARAMETERS

4.1 Soil texture

Knowledge of the soil type in the surface and subsoil of each field is essential for making accurate decisions on fertilizer and lime use. Without this knowledge it is not possible to use the recommendations in the guidelines effectively and to achieve optimum benefit from them. Soil type as used in this guideline is related to soil texture, which ranges from sands to clays. Soil texture is defined by the proportion of sand, silt and clay sized mineral particles in the soil. Texture is important because it influences the amount of water the soil can hold, the rate of water movement through the soil and how workable and fertile the soil is. For example, sand is well aerated but does not hold much water and is low in nutrients.

4.2 Soil organic matter

Soil organic matter helps bind soil mineral particles of sand, silt and clay into crumbs. It has a number of important functions in crop nutrition. It improves soil structure enabling roots to grow more easily throughout the soil to find nutrients. It holds phosphorus and potassium ions (the forms taken up by roots) very weakly so that they are readily available for uptake by roots. It holds a store of organic forms of nitrogen, phosphate and sulphur from which available forms of these nutrients are released by microbial action.

The amount of organic matter in a soil depends on the farming system, the soil type and climate. The interplay between the first two factors is such that, in general, for the same farming system, a clay soil holds more organic matter than a sandy soil, and for the same soil type, a grassland soil holds more organic matter than an arable soil. It is difficult to define a critical level of soil organic matter because there are so many combinations of soil type and farming system. However, maintaining and where possible increasing soil organic matter should be a priority.

Figure 2. Soil colour with organic matter

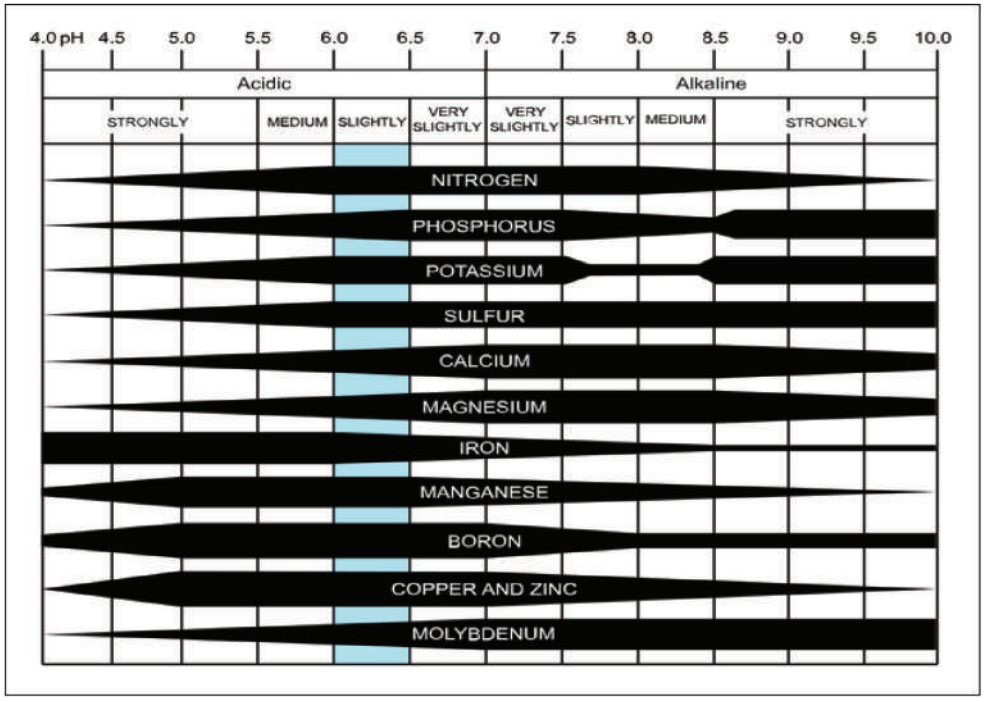
Image: Rodale Institute

4.3 Soil pH

The pH affects how tightly nutrients are bound to soil particles. If the soil pH is extremely high (basic) or very low (acidic), many nutrients become inaccessible to the plant because they are no longer dissolved in the soil water. The optimum pH for a plant varies with organic matter content and plant type. Decreasing soil pH directly increases the solubility of the plant nutrients manganese (Mn), zinc (Zn), copper (Cu), and iron (Fe). Acidic soils make these nutrients more available. The impact of pH on nutrient availability is very important both for maximum plant availability and to avoid potentially toxic levels at very low or very high pH.

The optimal pH for growth differs among plants. Most of the crops can grow on pH 5.5-6.5, however, a soil pH of 6.5 to 7.0 is often considered "ideal" for most plants.

Figure 3. Nutrient availability as affected by soil pH. The wider areas represent greater availability. The blue bar shows the optimum pH level for nutrient uptake by plants



(Source: https://en.m.wikipedia.org/wiki/File:Soil_pH_effect_on_nutrient_availability.svg)

5. LIME RECOMMENDATIONS AND GUIDE TO LIMING

For each field the amount of lime to apply will depend on the current soil pH, soil texture, soil organic matter and the optimum pH needed. Clay and organic soils need more limes than sandy soils to increase pH by one unit. A lime recommendation is usually for a 20 cm depth of cultivated soil or a 15 cm depth of grassland soil. The table below gives general lime recommended amounts (t/ac) of ground limestone or chalk.

Table 3. Lime requirement (tons/acre) needed to raise the soil pH to 6.5

Initial soil pH value	Soil type		
	Sand Sandy loam	Sandy clay loam	Silty clay loam Clay loam
6.40	0.24	0.28	0.32
6.30	0.49	0.57	0.65
6.20	0.73	0.85	0.97
6.10	0.97	1.13	1.30
6.00	1.21	1.42	1.62
5.90	1.46	1.70	1.94
5.80	1.70	1.98	2.27
5.70	1.94	2.27	2.59
5.60	2.19	2.55	2.91
5.50	2.43	2.83	3.24
5.40	2.67	3.12	3.56
5.30	2.91	3.40	3.89
5.20	3.16	3.68	4.21
5.10	3.40	3.97	4.53
5.00	3.64	4.25	4.86
4.90	3.89	4.53	5.18

(Source: Adapted from Soil Science, methods and application)

5.1 Guide to liming for acidic soils

Normally, no liming is required for soils with pH values of 6.5 and above. When selecting a liming material read the label and look for the Effective Neutralizing Value (ENV) which is used to calculate exactly how much lime to apply. A dolomitic type of lime, that provides both calcium and magnesium, will be recommended when both the soil pH and magnesium levels are low. The ENV indicates the amount of material that will react with soil acidity in the first year of application. Take the recommended lime rate and divide it by the % ENV to determine exactly how much to apply.

For example, if the soil test report states requirements for 5kg of lime for one acre and the product has an ENV of 90% you will actually have to apply 5.55kgs to change the soil pH.

5.1.1 When to lime

Liming materials should be mixed with the soil where possible. As even finely ground liming materials require several months to react. Apply lime well in advance of acid sensitive crops to allow time for it to neutralize soil acidity. Lime is usually added in winter for annual crops such as vegetable, just prior to digging, as the lime can take effect over the winter months and will not damage young growth. If planting perennial plants lawns, shrubs, fruits or trees, apply lime before planting. Surface applications of lime in established orchards move slowly into the soil and must be considered as long-term corrective or maintenance programs. Regularly scheduled applications of lime on a 2, 3 or 4-year interval basis, as predicted by soil tests, represent the best available means of maintaining pH and calcium and magnesium supplies in the soil.

5.1.2 Method of application

When applying more than 0.5kg per sq m, it is best to dig half into the soil and sprinkle rest on the surface of soil after digging. When applying less than 0.5kg per sq m, dig the entire amount in or sprinkle it on the surface if digging is not practical. The clay in the soil resists changes in pH (called buffering capacity) so that much more lime is needed to change the pH in the soils with high clay content than in soils with little clay, such as coarse sandy soil.

5.1.3 Liming materials

Lime raises pH and is usually added as ground limestone, commonly called ‘garden Lime’. The active ingredients calcium carbonate. Ground limestone is easy to spread. Ground magnesium limestone, often called “Dolomite lime” is a ground limestone rich in magnesium as well calcium carbonate and is used to lime soils that lack magnesium. Hydrated lime (calcium hydroxide), sold for use by builders, can also be used, it is fine powder, quick acting, but can irritate skin and eyes if not handled carefully. Liming materials are very finely ground so that they work quickly. Avoid any products with lumps, as they will take years to have any effect.

6. FERTILIZERS AND FERTILIZER USAGE IN BHUTAN

Fertilizers are materials that are applied to soils, or directly to plants, for their ability to supply the essential nutrients needed by crops to grow and improve soil fertility. They are used to increase crop yield and/or quality, as well as to sustain soils' ability to support future crop production. Mineral fertilizers are produced from materials mined from naturally occurring nutrient deposits, or from the fixation of nitrogen from the atmosphere into plant-available forms. Mineral fertilizers generally contain high concentrations of a single, or two or three, plant nutrients.

6.1 Common types of fertilizer

- Inorganic (Mineral) fertilizer- Fertilizer contains nutrients in the form of inorganic salts obtained by extraction and/or by physical and/or chemical industrial processes.
- Organic fertilizer- Carbonaceous materials mainly of vegetable and/or animal origin added to the soil specifically for the nutrition of plants.
- Straight fertilizer- A qualification generally given to a nitrogenous, phosphatic, or potassic fertilizer having only one primary plant nutrient, i.e. nitrogen, phosphorus or potassium.
- Complete fertilizer- A fertilizer that contains three major plant nutrients- nitrogen, phosphorus, and potassium.
- Micronutrient fertilizer-Any fertilizer containing micronutrient element(s) (zinc, boron, iron, manganese, copper, molybdenum or chlorine), which required in small amount but essential for plant growth.

6.2 Fertilizer usage in Bhutan

The fertilizer distribution records show a steady increase in the amount of fertilizer imported and distributed over the years. The total fertilizer imports in 1976-77 were 319 MT, which increased to 2,425 MT in 2000 and 3,604 MT in 2020. The fertilizer consumption per acre of the arable land (664,000 acres) is about 5.43 kg/acre (13.41 kg/ha), while per acre of the cultivated area (250.062 acre) is about 14.41 kg/acre (36 kg/ha).

Figure 4. Fertilizer use in trend from 2000-2020

6.3 Commonly used fertilizers in Bhutan

6.3.1 Single fertilizers

These are all simple fertilizers (containing only one primary nutrient). By using the correct amounts of all three in combination, the exact primary nutrient requirements of any crop can be applied.

- Urea (46% nitrogen – N);
- Single super phosphate (SSP) (16% phosphorus – P_2O_5);
- Muriate of potash (MoP) (60% potassium – K_2O);

6.3.2 Other fertilizers

Other fertilizers are available and are effective but have some disadvantages.

- Suphala (15:15:15/16:16:16 N: P_2O_5: K_2O) is a complete fertilizer (containing more than one nutrient) that contains N, P_2O_5, K_2O in equal quantities. Crops usually need most N than P_2O_5 and, K_2O and so suphala must be used with the recommended fertilizers to meet the crop nutrient requirements and to not use too much P_2O_5 and K_2O.

6.3.3 Nutrient contents of fertilizers

The nutrient concentration or content of a bag of fertilizer differs between fertilizers. It is written as a figure (%), which indicates the kg of the nutrient in 100 kg of fertilizer.

Table 4. Nutrient content of common fertilizer

Fertilizer	N	P_2O_5	K_2O		Fertilizer	N	P_2O_5	K_2O
Urea	45	0	0		MoP	0	0	60
SSP	0	16	0		Suphala	15/16	15/16	15/16

7. FERTILIZER APPLICATION

Accurate and even application of fertilizers is very important in order to maximise the benefits from their use to improve crop yield and quality and profitability. Even where correct decisions have been made on the amount of fertilizer to apply, inaccurate application, uneven spreading or spreading into hedgerows or ditches can cause a range of potentially serious problems, including:

- Uneven crops.
- Lodging and disease.
- Reduced yields and poor or uneven crop quality at harvest.
- More risk of the transfer of nutrients to watercourses at field margins causing nutrient pollution.
- More risk of causing botanical changes in hedgerows and field margins.

7.1 Timing/method of application

Three main terms are used to indicate the time to apply fertilizer.

7.2 Basal dressing

Application of fertilizer or manure at or before sowing or planting the crops. Slow nutrient releasing fertilizers such as SSP, MoP and suphala are best applied as basal dressing.

7.3 Top-dressing

Application of fertilizer or manure when the crop is standing in the field. Fast dissolving fertilizers such as urea are best applied by top-dressing.

7.4 Split application

Application of fertilizer or manure in split doses at different stages of crop growth to avoid nutrient losses through leaching or volatilisation. Urea is best applied in splits especially in light textured soils and in areas with high rainfall, because it is very soluble and does not stay in the rooting zone.

7.5 Balanced fertilizer use

This is the most important principle when applying fertilizers to crops, in order to ensure sustainable soil fertility and crop yields. It means the application of fertilizers and manures to supply all the essential plant nutrients (primary, secondary and micro), which the soil cannot provide in the amounts required for optimum crop growth and yield. Without balanced fertilizer applications, soil nutrient mining can take place due to the removal of soil nutrients through plant uptake resulting in rapid decline in soil fertility leading to reduce crop growth and yield. Apply the correct amounts of fertilizer at the right time and at the right rates in suitable conditions.

7.6 Nutrient uptake and removal by major crops

Nutrients taken up and removed by crops in the harvested product and the by-products should be replaced with external inputs (fertilizers, manures, etc.) to avoid depleting soil nutrient reserves. Table 5 shows for each of the main crops in Bhutan the amount of the primary nutrients removed from the soil by the main crops yielding 1 t (tonne) of produce in Bhutan.

Table 5. Crop nutrient uptake and removal by crops yielding 1 ton produce

Crop	N	P_2O_5	K_2O
	Kg per 1 ton		
Rice	18.00	3.00	17.00
Wheat	23.00	10.00	20.00
Maize	25.00	10.00	32.00
Potato	5.00	2.00	8.00
Chilli	32.00	3.00	42.00
Pea & Bean	24.00	6.00	16.00

7.7 Practical guidelines for effective fertilizer use

- Use SSP and MoP as a basal dressing before planting or sowing the crop. However, in areas with light textured soils and high rainfall, apply MoP in two or more splits to avoid losses through leaching.
- If urea is the only source of nitrogen, apply half the recommended rate as a basal dressing and use the remaining half to top-dress at the appropriate growth stage of the crop. If using a compound fertilizer like suphala, use urea to top dress in two or more splits.
- Always use FYM or compost at the rate of 2-3 t/acre to help maintain soil structure and fertility.
- Do not use fertilizer rates higher than the recommended rates as this wastes money. Fertilizer rates lower than the recommended may be used but yields and profitability will be less than for the recommended rates.
- To apply the exact recommendations, use single nutrient fertilizers (urea, SSP and MoP) together, or with a compound fertilizer (suphala). If using suphala (15:15:15/16:16;16), apply it at the rate needed to supply the amount of whichever recommended nutrient rate is the lowest (P_2O_5 or K_2O). Then use single nutrient fertilizers to supplement the additional nutrients wherever required.

8. ORGANIC FERTILIZERS

Organic fertilizers are derived from plant matter, animal excreta, sewage and food waste, generally in the form of animal manure, green manure and biosolids. Organic fertilizers provide essential nutrients needed by crops, generally containing a wide variety in low concentrations. They also play an important role in improving soil health. Organic fertilizers, particularly solid fertilizers (compost, vermicompost, farm yard manure), add useful amounts of organic matter to soils. Their use can improve water holding capacity, drought resistance and structural stability, as well as the biological activity of soils. These improvements are most likely to be achieved where regular manure applications are made over the years.

8.1 Farm yard manure (FYM)

Farmyard manure is the most common form of organic fertilizer applied to crops in Bhutan. Farmyard manure has a high proportion of organic material which nurtures soil organisms and is essential for maintaining an active soil life. Typically, only about half of the nutrient content of farmyard manure becomes available for crop growth during the first year after it is applied to the soil. The rest of the nutrients are channeled through soil biotic processes and are released in the following years. The high organic matter content and the more active soil life improve or maintain a friable soil structure, increase the cation exchange capacity, the water holding capacity, and the infiltration rate, and reducing the risk of soil pests.

8.2 Compost

Unlike manure, compost is very stable and not a readily available source of nutrients. The composting process uses heat and microbial activity to quickly decompose simple compounds like sugars and proteins, leaving behind more stable complex compounds such as lignins and humic acids. The stable products of composting are an important source of organic matter. The addition of compost increases available water capacity by improving water retention and pore space on which water and nutrients can bind. Compost is less effective at building soil aggregation than FYM, because the readily-degradable organic compounds have already been decomposed. Composts differ in their efficiency to suppress various crop pests, although they can sometimes be quite effective.

8.3 Vermicompost

Vermicomposting is a natural process whereby earthworms convert waste material with rigid structures into compost. The compost produced in this green process is traditionally and popularly used as a natural fertilizer for enhancing plant growth. During the vermicomposting process, earthworms play an important role in converting biodegradable organic matter into high quality manure. Earthworm gut microorganisms produce exoenzymes that help to degrade organic matter into forms of nutrients that are available for plant growth. Generally, vermicompost contains more nutrient levels compared to compost.

8.4 Concentrated organic manure

These are oil cake, slaughter house wastes, fish meal, guano and poultry manure which are rich in NPK. Being popular as animal feed, oil cakes are costly and should be applied to high value crops only. Cakes should be decomposed in water for 10-12 days if applied near the base of young seedlings.

8.5 Green manure crops

Green manure crops are those grown for the purpose of improving the soil fertility with microbial diversity and organic matter content in general as opposed to cover crops which are grown more for the purpose of erosion protection and cycling of nutrients. When incorporated, green manures add a lot of fresh, readily degradable material to the soil, which fuels the soil's microbial community. The increased production of microbial exudates helps hold the individual soil particles together as aggregates. A soil with better aggregation (aggregate stability) is more resilient in heavy rain storms and is capable of greater water infiltration. In reduced tillage systems, one way to get the added benefits of green manure crops is to only incorporate them in the planting row and use the killed crop between the rows as a mulch.

Any herbaceous plant may be used for green manuring, but plants of the family leguminosae are preferred because of the added advantage of getting fixed nitrogen. The common green manure plants include dhaincha (Sesbania aculeata), sunhemp (Crotalaria juncea), cowpea, grasspea, soybean, mungbean, blackgram and others.

Crop residue is another important source of organic matter. As it decomposes, the organic matter is going back into the soil and improving soil tilth. Crop residue left on the surface will protect against erosion and improve surface aggregation, thereby reducing crusting and surface compaction. However, diseased crop debris can harbor inoculum that can become a problem during the next season if a susceptible crop is planted. Crop rotation with non-host crops belonging to different plant families will reduce pathogen inoculum. Removal and composting of crop debris may be an option in some situations. Incorporation or plowing down of crop debris to encourage the decomposition process may be an option depending on the tillage system and crop rotation sequence being employed.

9. SOIL ORGANIC MATTER MANAGEMENT

Organic matter is the jewel in the crown: it plays such a critical role in improving and maintaining the physical, chemical and biological properties of soils. So, it's important to monitor and manage the soil to maintain the organic matter levels at the highest possible level to sustain soil's health and overall productivity. Organic matter levels can dramatically decrease due to erosion, cultivation, cropping, and burning of crop stubble. If the soil organic matter levels are low, options to improve them include:

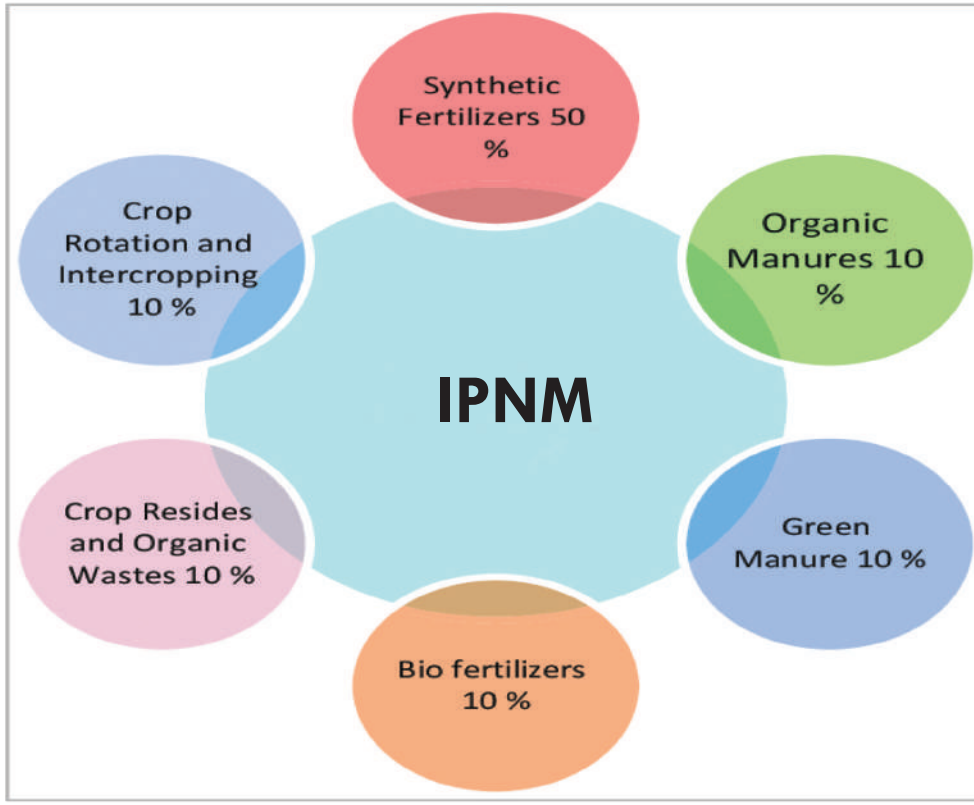
- Increasing inputs of organic matter such as manures, biosolids, composts can increase the organic matter percentage in a soil temporarily, but unless the additions are continued, the soil will revert to its steady state of equilibrium of organic matter.
- Growing more biomass can increase organic additions in the soil via decomposition of increased root mass and leaf litter.
- Green manure crops, particularly legume crops or mixes (e.g. vetch or peas with oats) that are grown and then slashed and/or turned into the soil before seed set.
- Including (in particular, perennial) grasses in pasture mix, as these tend to have a higher root-to-shoot ratio and can increase organic additions to the soil via the roots.
- Rotational grazing, which encourages extensive pasture root growth and maximizes pasture recovery time between grazing events (hence producing more organic matter for decomposition).
- Ensuring adequate supply of nutrients (fertilizer) to pastures to encourage greater plant root and general pasture growth.

10. INTEGRATED PLANT NUTRIENT MANAGEMENT (IPNM)

IPNM may be defined as 'an intelligent use of optimum combination of organic, inorganic and biological nutrient sources cropping system to achieve and sustain optimum yield without harming soil ecosystem. Such a package of plant nutrients formulated must be technically sound, economically viable, practically feasible, socially acceptable and environmentally safe. Briefly, IPNM system is a holistic approach and may be defined as maintenance of soil fertility and plant nutrient supply to an optimum level for sustaining the crop productivity at desired level.

IPNM system or integrated plant nutrient supply (IPNS) aims at achieving a harmony in the judicial and efficient use of chemical fertilizers in conjunction with organic manures, use of well-decomposed crop residues, recyclable waste, green manures, compost including vermicompost, inserting of legumes in cropping systems, use of bio-fertilizers and other locally available nutrient sources for sustaining soil health and amelioration of environment as well as crop productivity on long-term basis. The increase in crop productivity results from the combined effect of chemical and organic manures which also helps in the improvement of physical, chemical and biological properties and consequently the soil organic matter and nutrient status. Thus, IPNM system holds promise in sustaining higher crop yields besides improving soil health.

Figure 5: Components of IPNM



(Source: Adopted from floriculture Sustainability Initiative)

10.1 Benefits of Integrated Plant Nutrient Management

- Improve soil health and soil fertility.
- Enhance crop productivity.
- Reduce the use of chemical fertilizers.
- Provide balanced nutrition to crops.
- Promotes carbon sequestration and prevents the deterioration of soil, water, ecology, and also leaching of nutrients from the soil.

11. SOIL HEALTH

The terms 'soil health' and 'soil quality' are becoming increasingly familiar worldwide. A modern consensus definition of soil health is "the continued capacity of the soil to function as a vital living ecosystem that sustains plants, animals and humans."

Soil health invokes the idea that soil is an ecosystem full of life that needs to be carefully managed to regain and maintain our soil's ability to function optimally. When the soil is not functioning to its full capacity, sustainable productivity, environmental quality, and net farmer profits are jeopardized over the long term. Below are some examples of the economic benefits of maintaining and improving soil health:

- Better plant growth, quality, and yield.
- Reduced risk of yield loss during periods of environmental stress (e.g., heavy rain, drought, pest or disease outbreak).
- Better field access during wet periods.
- Reduced fuel costs by requiring less tillage.
- Reduced input costs by decreasing losses, and improving use.
- Increase efficiency of fertilizer, pesticide, herbicide, and irrigation applications.

11.1 Characteristic of a healthy soils

Good soil tilth: Soil tilth refers to the overall physical character of the soil in the context of its suitability for crop production. Soil with good tilth is crumbly, well structured, dark with organic matter, and has no large and hard clods.

Sufficient depth: Sufficient depth refers to the extent of the soil profile through which roots are able to grow to find water and nutrients. A soil with a shallow depth as a result of a compaction layer or past erosion is more susceptible to damage in extreme weather fluctuations, thus predisposing the crop to flooding, pathogen, or drought stress.

Good water storage and good drainage: During the heavy rain, a healthy soil will take in and store more water in medium and small pores, but will also drain water more rapidly from large pores. Thus, a healthy soil will retain more water for plant uptake during dry times, but will also allow air to rapidly move back in after rainfall, so that organisms can continue to thrive.

Sufficient supply but not excess of nutrients: An adequate and accessible supply of nutrients is necessary for optimal plant growth and for maintaining balanced cycling of nutrients within the system. An excess of nutrients can lead to leaching and potential ground water pollution, high nutrient runoff and greenhouse gas losses, as well as toxicity to plants and microbial communities.

Small population of plant pathogens and insect pests: In agricultural production systems, plant pathogens and pests can cause diseases and damage to the crop. In a healthy soil, the population of these organisms is low or is less active. This could result from direct competition from other soil organisms for nutrients or habitat, etc. In addition, healthy plants are better able to defend themselves against a variety of pests (somewhat analogous to the human immune system).

Large population of beneficial organisms: Soil organisms are important to the functioning of the soil. They help with cycling nutrients, decomposing organic matter, maintaining soil structure, bio- logically suppressing plant pests, etc. A healthy soil will have a large and diverse population of beneficial organisms to carry out these functions and thus help maintain a healthy soil status.

Low weed pressure: Weed pressure is a major constraint in crop production. Weeds compete with crops for water and nutrients that are essential for plant growth. Weeds can block sunlight, interfere with stand establishment and harvest and cultivation operations, and harbor disease causing pathogens and pests.

Free of chemicals and toxins that may harm the crop: Healthy soils are either devoid of excess amounts of harmful chemicals and toxins, or can detoxify or bind such chemicals. These processes make these harmful compounds unavailable for plant uptake, due to the soil's richness in stable organic matter and diverse microbial communities.

Resistant to degradation: A healthy, well aggregated soil full of a diverse community of living organisms is more resistant to adverse events including erosion by wind and rain, excess rainfall, extreme drought, vehicle compaction, disease outbreak, and other potentially degrading influences.

Resilience when unfavorable conditions occur: A healthy soil will rebound more quickly after a negative event, such as harvesting under wet soil conditions, or if land constraints restrict or modify planned rotations.

11.2 Building soil health

Organic matter is one of the smallest components of the soil system, but plays an essential role in maintaining soil health/functions. Soil organic matter is derived from living organisms, such as plants and animals, and their byproducts in the soil environment. When organic matter breaks down, it is transformed into different pools as sources of plant nutrients at various degrees of availability and eventually forms the final product called humus. This product becomes the central building block of healthy soil. Therefore, the maintenance of soil organic matter is critical to the health and productivity of the soil; providing a stable soil physical structure for

water storage, nutrient exchange with plant roots, aeration and a healthy microbial community will enhance soil health for healthy plant growth.

In agricultural systems, such as row cropping systems, significant stress is exerted on soil functions through management practices such as soil tillage, chemical application and continuous mono-cropping systems. However, management practices, such as soil conservation systems, including no-tillage and extended crop rotations can mitigate negative effects on soil health/functions. The extended crop rotations that include small grains, legumes and cover crops will increase soil biodiversity and protect the soil surface physically during the off season and provide organic carbon input. The introduction of perennials on marginal land can increase wildlife habitat and improve the biological and physical components of soil health. These practices are measures to build healthy soil, which can improve both productivity and the environment.

12. SOIL SAMPLING

Without a soil analysis, it's nearly impossible to tell what the soil needs to help the crop grow. A laboratory soil analysis, or a soil test, provides information on the capacity of the soil to supply adequate nutrients. This helps to select the correct mix of fertilizer, which can help to develop and maintain the soil and increase crop production.

A soil sample can help:

- Establish baseline soil nutrient status for new landowners.
- Determine nutrient application recommendations.
- Assess pH and the need for liming.
- Measure change in soil nutrient status over time.
- Document soil nutrient management for nutrient management.
- Avoid excessive nutrient applications or soluble salt accumulation.
- Develop a plan for possible variable-rate fertilizing within a field.

12.1 When to collect a soil sample?

For annual crops, such as vegetables, and cereals test soils before cultivation or after crop harvest. For perennial crops, such as orchards, and tree plantations, the most important time to test the soil is before planting so necessary nutrients can be incorporated into the soil, and for established orchard, the best time to test soil is after the harvest.

12.2 How to take a soil sample?

Most errors in soil testing occur when the sample is taken. Potential sources of errors include the following:

- Too few cores per sample.
- Failure to properly divide the area to be sampled.
- Failure to cover the whole area.
- Contaminated sample.

Taking a representative sample is important in soil testing. Use a trowel, spade and sampling tube/core samplers.

- For vegetables, field crops, and garden, take a 20 cm sample.
- For fruit trees, take top soil 20 cm, and sub soil 40 cm sample. Top soil and sub soil samples should be collected from the same pit/hole. The samples should not be mixed, and should be submitted separately for testing.
- At least 10-15 composite soil samples should be collected from the field. For fruit trees, soil samples should be collected under the tree canopy.

Soils should be analyzed often enough to recognize potential nutrient management issues before they adversely impact plant growth. In general, test every 2 to 3 years for annual crops, pastures, and legumes, and test every 3 to 5 years for fruit and nut trees, berries, and grapes. Take samples at the same time of year so results are comparable from year to year.

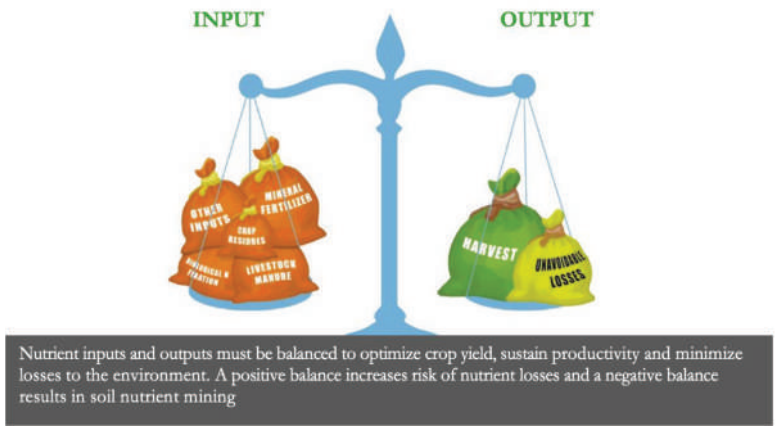
13. BACKGROUND TO FERTILIZER RECOMMENDATION

13.1 Why are fertilizers needed for healthy soils, productive and nutritious crops?

Nutrients are exported from the field when crops are harvested. This is called soil nutrient mining. The amount of nutrient removed by the harvest is specific to each crop and crop part and proportional to yield. To maintain soil fertility for sustainable crop yields and quality, nutrients exported from the field with the harvest and lost to the environment must be replaced by other organic and/or mineral fertilizer sources.

In soils where fertility is suboptimal, and where this practice is economically viable, it may be useful to apply higher nutrient application rates, in combination with other necessary soil fertility management practices, to alleviate nutrient-related limiting factors, improve nutrient availability to crops and enhance soil health. To achieve medium to high yields over time for improved food security and farmer's income, nutrients from indigenous sources, such as soil supply, atmospheric deposition, biological nitrogen fixation (BNF) and manure recycling, may not be sufficient. To maintain high yields, farmers usually require additional nutrient inputs, in the form of manufactured fertilizers or purchased organic nutrient sources. Limiting nutrients will be replenished by applying mineral and/or organic inputs and, in the case of manufactured fertilizers, by using multi-nutrient fertilizers or combining various complementary fertilizer materials.

Figure 6. Nutrient balance between input and output



(Source: Nutrient-Management-Book.pdf)

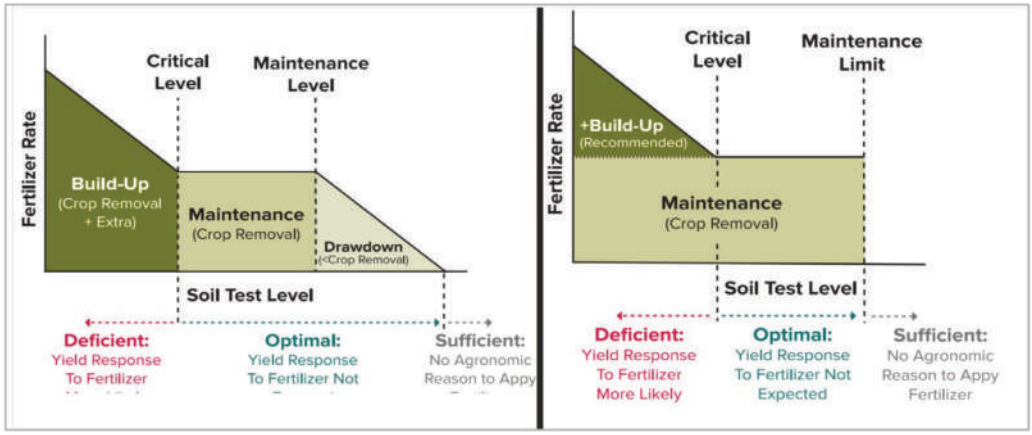
13.2 Developing fertilizer recommendation

Arriving at a correct fertilizer recommendation depends upon several factors related to both crop response to applied nutrients and a producer's objectives. Crop and site-specific fertilizer recommendations are developed using information from soil testing, tissue analysis, specific requirements for crop quality, desired economic and production goals, production practices, and potential environmental risks.

There are distinct recommendations based on soil test values: 1) build-up, 2) maintenance, and 3) drawdown (Figure 7). Overall, as soil test levels increase, recommended fertilizer rates decrease. At low soil test levels, the recommendations are in the build-up phase, where fertilizer rates include crop removal plus additional fertilizer to build soil test levels over the years. When soil test levels are at moderate levels, recommendations are designed to keep soil test levels in the maintenance range. Here, the fertilizer rates approximate crop removal, that is, nutrients removed from the harvested grain or forage. As soil test levels extend above the medium limit, the recommendations are in the drawdown phase.

In the drawdown phase, fertilizer rates are lower than crop removal, so soil test levels decrease over time to the maintenance limit. On a cautionary note, this recommendation does not apply to site-specific nutrient management, for which soil testing is a prerequisite before crop production.

Figure 7. Fertilizer recommendation framework for phosphorus and potassium adopted in the guidelines



(Source: Extensionpubs.osu.edu.)

Table 6. Probability of response to the added nutrients at different soil levels

Level of soil fertility	Response rating	Optimum fertilizer rates
Low	High response	High
Medium	Medium response	Medium
High	Low response	Low

Table 7. Overview of build-up, maintenance, and drawdown phase and fertilizer recommendation for phosphorus and potassium adopted in this guideline

Level of soil fertility	Response rating	Optimum fertilizer rates
Low	Build-up	Crop removal + additional fertilizer (crop removal + ≤20% extra) to build soil test levels to medium level
Medium	Maintenance	Crop removal
High	Drawdown	Crop removal - fertilizer (crop removal - ≤20%) to reduce soil test levels to medium range

13.3 Reference to fertilizer recommendation

The NSSC conducted numerous farmer-extension fertilizer use (FEFUT) and on-station trials in major crops in the country. These trials were conducted in collaboration with Dzongkahgs and research centers. The results of these trials have been used as the basis for the fertilizer recommendations.

The recommendations for crops with limited or no trial data, including hybrids, appended to these guidelines are based on substantial literature. The fertilizer recommendation is based on three principles (section 13.2).

14. DZONGKHAG WISE FERTILIZER RECOMMENDATIONS

14.1 Bumthang Dzongkhag

Soil nutrient status

	pH	OM%	Total N%	AvP (mg/kg)	AvK (mg/kg)	Texture
Rating class	5.50	5.71	0.25	14.12	129.00	loam
	Slightly acidic	High	Medium	Low	Medium	

The soil is slightly acidic but optimum for the production of most crops. The organic matter content is within the high range, total nitrogen and available potassium are in the medium range, whereas available phosphorus is within the low range. The soil texture is loam.

Fertilizer recommendation for cereals

Crop	Yield target (ton/ac)	Fertilizer recommendations (kg/ac)								
		Nutrients			Fertilizer (Option 1)			Fertilizer (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Rice	2.50	45.00	9.38	46.88	95.00	59.00	62.00	59.00	75.00	47.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the top-dressed urea into 2 equal parts and apply half at 20-35 days after transplanting (DAT) at tillering stage, and the remaining half at 40-50 DAT (panicle initiation stage).
- **Option 2:** Apply the entire dose of suphala, MoP and $^1/_3$ urea as basal dressing, then top-dress the other $^1/_3$ at 20-35 DAT (tillering stage) and the remaining $^1/_3$ at 40-50 DAT (panicle initiation stage).
- Do not apply urea top-dressing when heavy rainfall is expected.
- Do not apply urea on to standing water, under windy conditions, or at midday when the water temperature is highest.
- When top-dressing, close the terrace water inlets and outlets for at least three days.
- Use at least 2-3 tonnes/acre of FYM at land preparation and plough or cultivate it into the soil before sowing, planting or transplanting.

Crop	Yield target (ton/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizer (Option 1)			Fertilizer (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Wheat	1.20	27.60	13.80	24.00	58.00	86.00	40.00	86.00	29.00	17.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Top-dressed the other half immediately before the first irrigation, at crown root initiation stage (20-40 days after sowing depending on altitude).
- **Option 2:** Apply the entire dose of suphala and MoP as basal dressing, then top-dress the urea immediately before the first irrigation, at crown root initiation stage (20-40 days after sowing depending on altitude).
- To avoid unproductive tillering and secondary shoots, restrict nutrient supply (especially N) to early growth stages (i.e. start of tillering).
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrients			Fertilizer (Option 1)				Fertilizer (Option 2)	
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	MoP	SSP
Buckwheat	6.00	10.00	6.00	13.00	63.00	10.00	38.00		25.00

- **Option 1:** Apply the entire dose of SSP, MoP and urea as a basal dressing.
- **Option 2:** Apply the entire dose of suphala and SSP as basal dressing.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	MoP	SSP
Barley	4.50	13.00	13.00	5.00	13.00	12.00	28.00	14.00	53.00

- **Option 1:** Apply the entire dose of SSP, MoP and urea as a basal dressing.
- **Option 2:** Apply the entire dose of Suphala, MoP and SSP as a basal dressing.
- Use FYM 2-3 tonnes per acre at land preparation.

Fertilizer recommendation for potato

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizers (Option 1)			Fertilizers (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Potato	7.32	45.77	14.64	58.58	97.00	92.00	97.00	92.00	66.00	73.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Top-dressed half Urea at earthing up when the leaves are about 10-15 cm long, or at tuber initiation.
- **Option 2:** Apply the entire dose of Suphala and MoP and $^1/_3$ urea as basal dressing, then top-dress the remaining at earthing up when the leaves are about 10-15 cm long, or at tuber initiation.
- Potato uses large amounts of N, frequently more than the total applied as fertilizer. Therefore, it is advised to be applied in at least two to three spilt applications. However, excess N at or before tuberization can delay tuber growth and reduce yields.
- Potato requires high levels of available soil K. Potassium is relatively immobile in the soil. For best results, K fertilizers should be applied pre-plant and mixed into the seedbed.
- Phosphorus (P) is immobile in soil and therefore does not move from where it is placed. P fertilizers should either be mixed into the seedbed before planting or banded at planting.
- Place fertilizers close to but not in contact with seed tubers for more efficient fertilizer use.
- Use FYM 5 tonnes per acre at land preparation.

Fertilizer recommendation for vegetables

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Chilli (rainfed)	24.00	20.70	20.70	51.00	129.00	34.00	130.00	7.00	
Chilli (irrigated)	28.00	27.60	27.60	59.00	173.00	46.00	175.00		

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 top-dressings at 30 and 60 days after planting.
- **Option 2:** Apply entire suphala as a basal dressing and top-dressed urea at 30 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Cauliflower	40.00	27.60	36.80	85.00	173.00	61.00	173.00	26.00	15.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 30 and 60 days after planting.
- **Option 2:** Apply suphala and MoP as a basal dressing. Split the urea into 2 parts and top-dress at 30 and 60 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)									
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)			
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP	SSP
Cabbage	40.00	23.00	28.00	85.00	144.00	46.00	144.00	36.00	8.00	

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 30 and 45 days after planting.
- **Option 2:** Apply suphala and MoP as a basal dressing. Split the urea into 2 parts and top-dress at 30 and 45 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Tomato	18.75	5.75	17.25	40.00	36.00	29.00	36.00	28.00	19.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 20 and 45 days after planting.
- **Option 2:** Apply suphala, and MoP, as a basal dressing. Split the urea into 2 parts and top-dress at 20 and 45 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Time	Fertilizer Recommendations (kg/ac)									
		Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)			
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP	SSP
Asparagus 1st year 2nd year	Basal Side	20.00 60.00	36.00 40.00	20.00 86.00	44.00 130.00	225.00 250.00	43.00 143.00	125.00 250.00	43.00	76.00	100.00
Apply 2-3 tonnes of FYM /compost at transplanting. From the 2nd year, side dress fertilizer											
Beans	Basal	14.00	40.00	66.00	30.00	250.00	110.00	88.00		86.00	163.00
Apply 2-3 tonnes of FYM. Grows on wide range of soils, pH 5.5-6.8. Legume needs little N.											
Brinjal	Basal TD	16.00 16.00	28.00	13.20	35.00	175.00	22.00	83.00	6.00 35.00		93.00

Apply 4-5 tonnes of FYM. Best temperature for growth 25-30°C.TD (top-dress) 30 DAT											
Carrot	Basal	8.00	4.00	26.4	17.00	25.00	44.00	25.00	9.00	37.00	
Apply 4-5 tonnes of FYM. Needs K for proper development of roots.											
Chinese Cabbage	Basal TD1 TD2	20.00 10.00 10.00	30.00	17.60	43.00 22.00 22.00	188.00	29.00	110.00	5.00 26.00 26.00		76.00
Apply 5-6 tonnes of FYM. Requires well-drained soils, pH 6-6.8. 1st top dressing 30 DAT 2nd top dressing 60 DAT											
Cucumber	Basal TD	18.00 12.00	40.00	33.00	39.00 26.00	250.00	55.00	113.00	26.00	25.00	138.00
Apply 8-10 tonnes of FYM. Top dress 4-6 weeks after planting.											
Lettuce	Basal	8.00	16.00	8.00	17.00	100.00	13.00	50.00			50.00
Apply 2-3 tonnes of FYM. Needs continuous moisture so irrigation /water source essential											
Onion	Basal TD	20.00 20.00	30.00	33.00	44.00	188.00	55.00	125.00	44.00	22.00	63.00
Apply 5 tonnes of FYM. Grows on any soil with good FYM/OM. Bulbs may be poor on heavy wet soils. Optimum pH 6.0-6.8. Top-dress 30 DAP.											
Pea	Basal	20.00	32.00	38.50	43.00	200.00	64.00	125.00		31.00	75.00
Apply 2-3 tonnes of FYM. Grows on all soils, except if waterlogged or compacted. Legume so needs little N.											
Radish	Basal	20.00	16.00	33.00	43.00	100.00	55.00	100.00	9.00	28.00	
Apply 2-3 tonnes of FYM. Grows best in light OM-rich soil pH 6.6-6.8.											
Saag and Spinach	Basal	30.00	30.00	33.00	65.00	188.00	55.00	188.00		5.00	
Apply 8-10 tonnes of FYM. Grow well in all soils; prefer well drained and adequate FYM/OM. pH 6-6.8.											
NB: TD = Top dressing; DAP = Days after planting; DAT = Days after transplanting FYM = farmyard manure; OM = Organic matter e.g. FYM, compost, leaf litter											

Fertilizer recommendation for fruit plants and plantation crops

Pome fruits	Plant Nutrient	Non-Bearing trees (g/tree/yr)		Bearing trees (g/tree/yr)		Matured trees (g/tree/yr)	
		Nutrient	Fertilizer	Nutrient	Fertilizer	Nutrient	Fertilizer (g)
Apple Pear	N	56	122g Urea	62	135g Urea	82	178g Urea
	P_2O_5	16	100g SSP	32	200g SSP	48	300g SSP
	K_2O	75	125g MoP	110	183g MoP	135	224g MoP
		Using suphala: Apply suphala:100g, urea: 87g and MoP: 98g		Using suphala: Apply suphala: 200g, urea: 65g and MoP: 129g		Using suphala: Apply suphala: 300g, urea: 74g and MoP: 144g	
	Using single fertilizer split N application, half in December-February with full P &K and, remaining half in June. Irrigate /moisten the soils after fertilizer application. Using suphala, apply entire amount of suphala and MoP fertilizer in December-February. Split N application, half in December-February and, remaining half in June. FYM to be applied based upon availability						

Stone fruits	Plant Nutrient	1 year old (g/tree/yr)		2-4 years old (g/tree/yr)		5 year onwards (g/tree/yr)	
		Nutrient	Fertilizer	Nutrient	Fertilizer	Nutrient	Fertilizer (g)
Peach Plum Apricot Almond Cherry	N	23	50g Urea	43	93g Urea	28	61g Urea
	P_2O_5	16	100g SSP	32	200g SSP	48	300g SSP
	K_2O	43	71g MoP	71	118g MoP	99	164g MoP
		Using suphala: Apply suphala:100g urea: 15g and MoP: 45g		Using suphala: Apply suphala: 200g urea: 24g and MoP: 65g		Using suphala: Apply suphala: 175g SSP: 125g and MoP: 118g	
	Using single fertilizer split N application, half in December-February with full P &K and, remaining half in June. Irrigate /moisten the soils after fertilizer application. Using suphala, apply entire amount of suphala, SSP and MoP fertilizer in December-February. Split N application, half in December-February and, remaining half in June. FYM to be applied upon availability.						

14.2 Chhukha Dzongkhag

Soil nutrient status

	pH	OM%	Total N%	AvP (mg/kg)	AvK (mg/kg)	Texture
Rating class	5.06	5.84	0.31	11.23	61.72	Clay Loam
	Very acidic	High	Medium	Low	Low	

The soil is very acidic (refer to lime recommendation section 5), with low levels of available potassium and phosphorus. The total nitrogen levels are within the medium range, whereas the organic matter is within the high range. The soil texture is clay loam.

Fertilizer recommendation for cereals

Crop	Yield target (ton/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizer (Option 1)			Fertilizer (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Rice	2.50	56.25	9.38	46.88	119.00	59.00	78.00	59.00	99.00	62.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the top-dressed urea into 2 equal parts and apply half at 20-35 days after transplanting (DAT) at tillering stage, and the remaining half at 40-50 DAT (panicle initiation stage).
- **Option 2:** Apply the entire dose of suphala, MoP and $^1/_3$ urea as basal dressing, then top-dress the other $^1/_3$ at 20-35 DAT (tillering stage) and the remaining $^1/_3$ at 40-50 DAT (panicle initiation stage).
- Do not apply urea top-dressing when heavy rainfall is expected.
- Do not apply urea on to standing water, under windy conditions before canopy closure, or at midday when the water temperature is highest.
- When top-dressing, close the terrace water inlets and outlets for at least three days.
- Use at least 2-3 tonnes/acre of FYM at land preparation and plough or cultivate it into the soil before sowing, planting or transplanting.

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizer (Option 1)				Fertilizer (Option 2)	
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Wheat	1.20	27.60	13.80	30.00	56.00	86.00	50.00	86.00	29.00	27.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Top-dressed the other half immediately before the first irrigation, at crown root initiation stage (20-40 days after sowing depending on altitude).
- **Option 2:** Apply the entire dose of suphala and MoP as basal dressing, then top-dress the urea immediately before the first irrigation, at crown root initiation stage (20-40 days after sowing depending on altitude).
- To avoid unproductive tillering and secondary shoots, restrict nutrient supply (especially N) to early growth stages (i.e. start of tillering).
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrients			Fertilizer (Option 1)				Fertilizer (Option 2)	
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	MoP	SSP
Buckwheat	6.00	14.00	8.00	13.00	88.00	13.00	38.00	3.00	50.00

- **Option 1:** Apply the entire dose of SSP, MoP and urea as a basal dressing.
- **Option 2:** Apply the entire dose of suphala, MoP and SSP as basal dressing.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrients			Fertilizer (Option 1)				Fertilizer (Option 2)	
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	SSP
Millet	24.00	14.00	13.00	52.00	88.00	22.00	81.25	24.00	6.25

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing and, apply the other half urea 30-40 days after sowing
- **Option 2:** Apply the entire dose of suphala and MoP and, apply urea as top-dressing 30-40 days after sowing.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Maize	1.80	45.00	22.50	72.00	95.00	141.00	120.00	141.00	48.00	82.00

- **Option 1:** Apply the entire dose of SSP, MoP and $^1/_3$ urea as a basal dressing. Top-dressed $^1/_3$ urea at 35-40 days after planting (knee high stage) and the remaining $^1/_3$ at 60-70 days (tasseling stage).
- **Option 2:** Apply the entire dose of suphala, MoP as basal dressing. Top-dress half urea at 35-40 days after planting (knee high stage) and the remaining half at 60-70 days (tasseling stage).
- Use FYM 2-3 tonnes per acre at land preparation.

Fertilizer recommendation for potato

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizers (Option 1)			Fertilizers (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Potato	7.98	39.91	15.96	63.86	84.00	100.00	106.00	100.00	51.00	80.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Top-dressed half urea at earthing up when the leaves are about 10-15 cm long, or at tuber initiation.
- **Option 2:** Apply the entire dose of suphala and MoP and $^1/_3$ urea as basal dressing, then top-dress the remaining at earthing up when the leaves are about 10-15 cm long, or at tuber initiation.
- Potato uses large amounts of N, frequently more than the total applied as fertilizer. Therefore, it is advised to be applied in at least two to three spilt applications. However, excess N at or before tuberization can delay tuber growth and reduce yields.
- Potato requires high levels of available soil K. Potassium is relatively immobile in the soil. For best results, K fertilizers should be applied pre-plant and mixed into the seedbed.
- Phosphorus (P) is immobile in soil and therefore does not move from where it is placed. P fertilizers should either be mixed into the seedbed before planting or banded at planting.
- Place fertilizers close to but not in contact with seed tubers for more efficient fertilizer use.
- Use FYM 5 tonnes per acre at land preparation.

Fertilizer recommendation for mustard

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrients			Fertilizers (Option 1)			Fertilizers (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Mustard	20.00	12.00	13.00	43.00	72.00	21.00	72.00	18.00	2.00

- **Option 1:** Apply the entire dose of SSP, MoP and urea as a basal dressing.
- **Option 2:** Apply the entire dose of suphala, urea and, MoP as basal dressing.

Fertilizer recommendation for vegetables

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Chilli (rainfed)	24.00	20.70	22.50	51.00	129.00	34.00	129.00	7.00	3.00
Chilli (irrigated)	28.00	27.60	30.00	59.00	173.00	50.00	173.00		4.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 top-dressings at 30 and 60 days after planting.
- **Option 2:** Apply entire suphala and MoP as a basal dressing and top-dressed urea.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Cauliflower	40.00	27.60	40.00	85.00	173.00	61.00	173.00	26.00	15.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 30 and 60 days after planting.
- **Option 2:** Apply suphala and MoP as a basal dressing. Split the urea into 2 parts and top-dress at 30 and 60 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)									
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)			
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP	SSP
Cabbage	40.00	23.00	30.00	85.00	144.00	50.00	144.00	36.00	12.00	

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 30 and 45 days after planting.
- **Option 2:** Apply suphala and MoP as a basal dressing. Split the Urea into 2 parts and top-dress at 30 and 45 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Tomato	18.75	5.75	18.75	40.00	36.00	31.00	36.00	28.00	22.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 20 and 45 days after planting.
- **Option 2:** Apply suphala, and MoP, as a basal dressing. Split the urea into 2 parts and top-dress at 20 and 45 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Time	Fertilizer Recommendations (kg/ac)									
		Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)			
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP	SSP
Asparagus 1st year 2nd year	Basal Side	20.00 60.00	36.00 40.00	20.00 90.00	43.00 130.00	225.00 250.00	33.00 149.00	125.00 250.00	 43.00	 83.00	100.00
Apply 2-3 tonnes of FYM /compost at transplanting. From the 2nd year, side dress fertilizer											
Beans	Basal	14.00	40.00	69.00	30.00	250.00	115.00	88.00		91.00	163.00
Apply 2-3 tonnes of FYM. Grows on wide range of soils, pH 5.5-6.8. Legume needs little N.											
Brinjal	Basal TD	16.00 16.00	28.00	13.80	35.00	181.00	23.00	87.00	5.00 35.00		95.00
Apply 4-5 tonnes of FYM. Best temperature for growth 25-30°C.TD (top-dress) 30 DAT											
Carrot	Basal	8.00	4.00	27.60	17.00	25.00	46.00	25.00	9.00	39.00	
Apply 4-5 tonnes of FYM. Needs K for proper development of roots.											
Chinese Cabbage	Basal TD1 TD2	20.00 10.00 10.00	30.00	18.40	43.00 22.00 22.00	188.00	31.00	115.00	3.00 22.00 22.00		73.00
Apply 5-6 tonnes of FYM. Requires well-drained soils, pH 6-6.8. 1st top dressing 30 DAT 2nd top dressing 60 DAT											
Cucumber	Basal TD	18.00 12.00	40.00	34.50	39.00 26.00	250.00	57.00	113.00	 26.00	27.00	138.00
Apply 8-10 tonnes of FYM. Requires good moisture & FYM/OM. Loamy soils best, pH 5.5-6.8. Top dress 4-6 weeks after planting.											
Lettuce	Basal	8.00	16.00	9.20	17.00	100.00	15.00	50.00			50.00
Apply 2-3 tonnes of FYM. Needs continuous moisture so irrigation /water source essential											
Onion	Basal TD	20.00 20.00	30.00	34.50	43.00	188.00	57.00	125.00	 44.00	24.00	63.00
Apply 5 tonnes of FYM. Grows on any soil with good FYM/OM. Bulbs may be poor on heavy wet soils. Optimum pH 6.0-6.8. Top-dress 30 DAP.											
Pea	Basal	20.00	32.00	40.25	43.00	200.00	67.00	125.00		34.00	75.00
Apply 2-3 tonnes of FYM. Grows on all soils, except if waterlogged or compacted. Legume so needs little N.											
Radish	Basal	20.00	16.00	34.50	43.00	100.00	57.00	100.00	9.00	31.00	
Apply 2-3 tonnes of FYM. Grows best in light OM-rich soil pH 6.6-6.8.											
Saag and Spinach	Basal	30.00	30.00	34.50	65.00	188.00	57.00	188.00		7.00	
Apply 8-10 tonnes of FYM. Grow well in all soils; prefer well drained and adequate FYM/OM. pH 6-6.8.											
NB: TD = Top dressing; DAP = Days after planting; DAT = Days after transplanting FYM = farmyard manure; OM = Organic matter e.g. FYM, compost, leaf litter											

Fertilizer recommendation for fruit trees and other plantation crops

Fruit tree	Plant Nutrient	Non-Bearing trees (g/tree/yr)		Bearing trees (g/tree/yr)	
		Nutrient	Fertilizer	Nutrient	Fertilizer
Citrus	N	75	163g Urea	200	435g Urea
	P_2O_5	50	313g SSP	100	625g SSP
	K_2O	150	249g MoP	350	581g MoP
		Using suphala: Apply suphala:313g, urea: 54g and MoP: 166		Using suphala: Apply suphala: 625g, urea: 217g and MoP 415g	
	Fertilizer application: After harvest & prior to spring flush. FYM to be applied upon availability				

Plantation crop	Plant Nutrient	Year 1 (g/palm/year)		Year 2 (g/palm/year)		Year 3 (g/palm/year)	
		Nutrient	Fertilizer (g)	Nutrient	Fertilizer (g)	Nutrient	Fertilizer (g)
Areca-nut	N	57	124g Urea	62	135g Urea	82	178g Urea
	P_2O_5	16	100g SSP	32	200g SSP	48	300g SSP
	K_2O	90	149g MoP	120	199g MoP	150	249g MoP
		Using suphala: Apply suphala:100g, urea: 89g and MoP: 123g		Using suphala: Apply suphala: 200g, urea: 65g and MoP: 146		Using suphala: Apply suphala: 300g, urea 74g and MoP 159g	

- Apply farmyard manure in planting pit and yearly 1-3 baskets/palm/year, according to tree size. FYM and compost may be applied in single dose in September – October.
- The fertilizer may be applied in two split doses: one third of the fertilizer may be applied in May-June and two third along with the organics during September –October.
- The first dose of fertilizers may be applied in basins of about 1m radius, made around the palm to a depth of 15-20cm.
- The second dose of fertilizers can be applied to the base of each palm all around and mixed with the soil by a light forking.

14.3 Dagana Dzongkhag

Soil nutrient status

	pH	OM%	Total N%	AvP (mg/kg)	AvK (mg/kg)	Texture
Rating class	5.80	2.80	0.16	31.00	139.00	Clay Loam
	Slightly acidic	Medium	Low	High	Medium	

The soil is slightly acidic but adequate for the production of most of the crops. Organic matter and available potassium are within moderate levels. The soil contains a low level of total nitrogen, whereas the available phosphorus is in the high range. The soil texture is clay loam.

Fertilizer recommendation for cereals

Crop	Yield target (ton/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizer (Option 1)			Fertilizer (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Rice	2.00	45.00	6.60	30.00	98.00	41.00	50.00	41.00	83.00	39.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the top-dressed urea into 2 equal parts and apply half at 20-35 days after transplanting (DAT) at tillering stage, and the remaining half at 40-50 DAT (panicle initiation stage).
- **Option 2:** Apply the entire dose of suphala, MoP and $^1/_3$ urea as basal dressing, then top-dress the other $^1/_3$ at 20-35 DAT (tillering stage) and the remaining $^1/_3$ at 40-50 DAT (panicle initiation stage).
- Do not apply urea top-dressing when heavy rainfall is expected.
- Do not apply urea on to standing water, under windy conditions before canopy closure, or at midday when the water temperature is highest.
- When top-dressing, close the terrace water inlets and outlets for at least three days.
- Use at least 2-3 tonnes/acre of FYM at land preparation and plough or cultivate it into the soil before sowing, planting or transplanting.

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizer (Option 1)				Fertilizer (Option 2)	
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Wheat	1.20	27.60	9.00	24.00	60.00	56.00	40.00	56.00	40.00	25.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Top-dressed the other half immediately before the first irrigation, at crown root initiation stage (20-40 days after sowing depending on altitude).
- **Option 2:** Apply the entire dose of suphala and MoP as basal dressing, then top-dress the urea immediately before the first irrigation, at crown root initiation stage (20-40 days after sowing depending on altitude).
- To avoid unproductive tillering and secondary shoots, restrict nutrient supply (especially N) to early growth stages (i.e. start of tillering).
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrients			Fertilizer (Option 1)				Fertilizer (Option 2)	
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	MoP	SSP
Buckwheat	6.00	6.00	6.00	13.00	38.00	10.00	38.00		

- **Option 1:** Apply the entire dose of SSP, MoP and urea as a basal dressing.
- **Option 2:** Apply the entire dose of suphala as basal dressing.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrients			Fertilizer (Option 1)				Fertilizer (Option 2)	
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Millet	24.00	10.00	11.00	52.00	63.00	18.00	63.00	30.00	2.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing and, apply the other half urea 30-40 days after sowing
- **Option 2:** Apply the entire dose of suphala and MoP and, apply urea as top-dressing 30-40 days after sowing.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Yield target (Mt/ ac)	Fertilizer Recommendations (kg/ac)									
		Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)			
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP	SSP
Maize (Local)		32.00	13.50	12.00	70.00	84.00	20.00	75.00	43.00		9.00
Maize (Improved)	1.80	45.00	13.50	57.60	98.00	84.00	96.00	84.00	68.00	73.00	

- **Option 1:** Apply the entire dose of SSP, MoP and $^1/_3$ urea as a basal dressing. Top-dressed $^1/_3$ urea at 35-40 days after planting (knee high stage) and the remaining $^1/_3$ at 60-70 days (tasseling stage).
- **Option 2:** Apply the entire dose of suphala, MoP and SSP as basal dressing. Top-dress half urea at 35-40 days after planting (knee high stage) and the remaining half at 60-70 days (tasseling stage).
- Use FYM 2-3 tonnes per acre at land preparation.

Fertilizer recommendation for potato

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizers (Option 1)			Fertilizers (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Potato	3.45	21.56	5.18	27.60	47.00	32.00	46.00	32.00	36.00	37.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Top-dressed half urea at earthing up when the leaves are about 10-15 cm long, or at tuber initiation.
- **Option 2:** Apply the entire dose of suphala and MoP and $^1/_3$ urea as basal dressing, then top-dress the remaining at earthing up when the leaves are about 10-15 cm long, or at tuber initiation.
- Potato uses large amounts of N, frequently more than the total applied as fertilizer. Therefore, it is advised to be applied in at least two to three spilt applications. However, excess N at or before tuberization can delay tuber growth and reduce yields.

- Potato requires high levels of available soil K. Potassium is relatively immobile in the soil. For best results, K fertilizers should be applied pre-plant and mixed into the seedbed.
- Phosphorus (P) is immobile in soil and therefore does not move from where it is placed. P fertilizers should either be mixed into the seedbed before planting or banded at planting.
- Place fertilizers close to but not in contact with seed tubers for more efficient fertilizer use.
- Use FYM 5 tonnes per acre at land preparation.

Fertilizer recommendation for mustard

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrients			Fertilizers (Option 1)			Fertilizers (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Mustard	20.00	7.50	10.00	43.00	47.00	17.00	47.00	27.00	4.00

- **Option 1:** Apply the entire dose of SSP, MoP and urea as a basal dressing.
- **Option 2:** Apply the entire dose of suphala, urea and, MoP as basal dressing.

Fertilizer recommendation for vegetables

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Chilli (rainfed)	24.00	13.50	18.00	52.00	84.00	30.00	84.00	23.00	7.00
Chilli (irrigated)	30.00	18.00	24.00	65.00	113.00	40.00	113.00	26.00	10.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 top-dressings at 30 and 60 days after planting.
- **Option 2:** Apply entire Suphala and MoP as a basal dressing. Split the other half urea into 2 top-dressing at 30 and 60 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Cauliflower	40.00	18.00	32.00	87.00	113.00	53.00	113.00	48.00	23.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 30 and 60 days after planting.
- **Option 2:** Apply suphala and MoP as a basal dressing. Split the urea into 2 parts and top-dress at 30 and 60 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)									
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)			
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP	SSP
Cabbage	40.00	15.00	24.00	87.00	94.00	40.00	94.00	54.00	15.00	

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 30 and 45 days after planting.
- **Option 2:** Apply suphala, and MoP as a basal dressing. Split the urea into 2 parts and top-dress at 30 and 45 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Tomato	18.75	3.75	15.00	41.00	23.00	25.00	23.00	33.00	19.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 20 and 45 days after planting.
- **Option 2:** Apply suphala, and MoP, as a basal dressing. Split the urea into 2 parts and top-dress at 20 and 45 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Time	Fertilizer Recommendations (kg/ac)									
		Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)			
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP	SSP
Asparagus 1st year 2nd year	 Basal Side	 20.00 60.00	 28.00 40.00	 16.00 90.00	 43.00 130.00	 175.00 250.00	 27.00 149.00	 100.00 250.00	 9.00 43.00	 83.00	 75.00
Apply 2-3 tonnes of FYM /compost at transplanting. From the 2nd year, side dress fertilizer											
Beans	Basal	14.00	36.00	66.00	30.00	225.00	110.00	88.00		86.00	138.00
Apply 2-3 tonnes of FYM. Grows on wide range of soils, pH 5.5-6.8. Legume needs little N.											
Brinjal	Basal TD	16.00 16.00	25.00	13.00	35.00	156.00	22.00	82.00	7.00 35.00		75.00
Apply 4-5 tonnes of FYM. Best temperature for growth 25-30°C.TD (top-dress) 30 DAT											
Carrot	Basal	8.00	4.00	26.00	17.00	25.00	43.00	25.00	9.00	37.00	
Apply 4-5 tonnes of FYM. Needs K for proper development of roots.											
Chinese Cabbage	Basal TD1 TD2	20.00 10.00 10.00	27.00	17.60	43.00 22.00 22.00	169.00	29.00	110.00	5.00 26.00 26.00		59.00
Apply 5-6 tonnes of FYM. Requires well-drained soils, pH 6-6.8. 1st top dressing 30 DAT 2nd top dressing 60 DAT											
Cucumber	Basal TD	18.00 12.00	36.00	33.00	39.00 26.00	225.00	55.00	113.00	26.00	25.00	113.00
Apply 8-10 tonnes of FYM. Requires good moisture & FYM/OM. Loamy soils best, pH 5.5-6.8. Top dress 4-6 weeks after planting.											
Lettuce	Basal	8.00	14.40	8.80	17.00	90.00	15.00	50.00			40.00
Apply 2-3 tonnes of FYM. Needs continuous moisture so irrigation /water source essential											
Onion	Basal TD	20.00 20.00	27.00	33.00	43.00 43.00	169.00	55.00	125.00	43.00	22.00	44.00
Apply 5 tonnes of FYM. Grows on any soil with good FYM/OM. Bulbs may be poor on heavy wet soils. Optimum pH 6.0-6.8. Top-dress 30 DAP.											
Pea	Basal	20.00	28.80	38.50	43.00	180.00	64.00	125.00		31.00	55.00
Apply 2-3 tonnes of FYM. Grows on all soils, except if waterlogged or compacted. Legume so needs little N.											
Radish	Basal	20.00	14.40	33.00	43.00	90.00	55.00	90.00	12.00	31.00	
Apply 2-3 tonnes of FYM. Grows best in light OM-rich soil pH 6.6-6.8.											
Saag and Spinach	Basal	30.00	27.00	33.00	65.00	169.00	55.00	167.00	7.00	10.00	
Apply 8-10 tonnes of FYM. Grow well in all soils; prefer well drained and adequate FYM/OM. pH 6-6.8.											
NB: TD = Top dressing; DAP = Days after planting; DAT = Days after transplanting FYM = farmyard manure; OM = Organic matter e.g. FYM, compost, leaf litter											

Fertilizer recommendation for fruit plants and plantation crops

Fruit tree	Plant Nutrient	Non-Bearing trees (g/tree/yr)		Bearing trees (g/tree/yr)	
		Nutrient	Fertilizer	Nutrient	Fertilizer
Citrus	N	100	217g Urea	250	544g Urea
	P_2O_5	25	156g SSP	50	313g SSP
	K_2O	125	208g MoP	300	498g MoP
		Using suphala: Apply suphala: 156g urea: 163g and MoP: 166		Using suphala: Apply suphala: 313g urea: 435g urea, MoP 415g	
	Fertilizer application: After harvest & prior to spring flush. FYM to be applied upon availability				

Plantation crop	Plant Nutrient	Year 1 (g/palm/year)		Year 2 (g/palm/year)		Year 3 (g/palm/year)	
		Nutrient	Fertilizer (g)	Nutrient	Fertilizer (g)	Nutrient	Fertilizer (g)
Areca-nut	N	60	130g Urea	97	211g Urea	120	261g Urea
	P_2O_5	13	81g SSP	25	156g SSP	35	219g SSP
	K_2O	45	75g MoP	85	141g MoP	135	224g MoP
		Using suphala: Apply suphala: 81g, urea: 102g and MoP: 53g		Using suphala: Apply suphala: 156g, urea: 157g and MoP: 100g		Using suphala: Apply suphala: 219g, urea: 185g, and MoP: 166g	

- ❖ Apply farmyard manure in planting pit and yearly 1-3 baskets/palm/year, according to tree size. FYM and compost may be applied in single dose in September – October.
- ❖ The fertilizer may be applied in two split doses: one third of the fertilizer may be applied in May-June and two third along with the organics during September –October.
- ❖ The first dose of fertilizers may be applied in basins of about 1m radius, made around the palm to a depth of 15-20cm.
- ❖ The second dose of fertilizers can be applied to the base of each palm all around and mixed with the soil by a light forking.

14.4 Gasa Dzongkhag

Soil nutrient status

	pH	OM%	Total N%	AvP (mg/kg)	AvK (mg/kg)	Texture
Rating class	5.11	4.24	0.28	9.00	68.80	Loam
	Very acidic	Medium	Medium	Low	Low	

The soil is very acidic (refer to lime recommendation section 5). The organic matter and total nitrogen levels are within the medium range, whereas the available phosphorus and potassium are within the low range. The soil texture is loam.

Fertilizer recommendation for cereals

Crop	Yield target (ton/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizer (Option 1)			Fertilizer (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Rice	2.50	56.25	9.38	43.12	122.00	59.00	72.00	59.00	102.00	56.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the top-dressed urea into 2 equal parts and apply half at 20-35 days after transplanting (DAT) at tillering stage, and the remaining half at 40-50 DAT (panicle initiation stage).
- **Option 2:** Apply the entire dose of suphala, MoP and $^1/_3$ urea as basal dressing, then top-dress the other $^1/_3$ at 20-35 DAT (tillering stage) and the remaining $^1/_3$ at 40-50 DAT (panicle initiation stage).
- Do not apply urea top-dressing when heavy rainfall is expected.
- Do not apply urea on to standing water, under windy conditions before canopy closure, or at midday when the water temperature is highest.
- When top-dressing, close the terrace water inlets and outlets for at least three days.
- Use at least 2-3 tonnes/acre of FYM at land preparation and plough or cultivate it into the soil before sowing, planting or transplanting.

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizer (Option 1)				Fertilizer (Option 2)	
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Wheat	1.20	27.60	15.00	30.00	60.00	94.00	50.00	94.00	27.00	25.00

- **Option 1:** Apply the entire dose of SSP, MoP and half rea as a basal dressing. Top-dressed the other half immediately before the first irrigation, at crown root initiation stage (20-40 days after sowing depending on altitude).
- **Option 2:** Apply the entire dose of suphala and MoP as basal dressing, then top-dress the urea immediately before the first irrigation, at crown root initiation stage (20-40 days after sowing depending on altitude).
- To avoid unproductive tillering and secondary shoots, restrict nutrient supply (especially N) to early growth stages (i.e. start of tillering).
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrients			Fertilizer (Option 1)				Fertilizer (Option 2)	
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	MoP	SSP
Buckwheat	6.00	14.00	8.00	13.00	88.00	13.00	38.00	3.00	50.00

- **Option 1:** Apply the entire dose of SSP, MoP and urea as a basal dressing.
- **Option 2:** Apply the entire dose of suphala, MoP and SSP as basal dressing.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrients			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	MoP	SSP
Barley	4.50	18.00	18.00	10.00	113.00	30.00	28.00	22.00	84.00

- **Option 1:** Apply the entire dose of SSP, MoP and urea as a basal dressing.
- **Option 2:** Apply the entire dose of suphala, MoP, and SSP as basal dressing.
- Use FYM 2-3 tonnes per acre at land preparation.

Fertilizer recommendation for potato

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizers (Option 1)			Fertilizers (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Potato	4.45	22.77	11.14	44.54	50.00	70.00	74.00	70.00	25.00	55.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Top-dressed half urea at earthing up when the leaves are about 10-15 cm long, or at tuber initiation.
- **Option 2:** Apply the entire dose of suphala and MoP and $^1/_3$ urea as basal dressing, then top-dress the remaining at earthing up when the leaves are about 10-15 cm long, or at tuber initiation.
- Potato uses large amounts of N, frequently more than the total applied as fertilizer. Therefore, it is advised to be applied in at least two to three spilt applications. However, excess N at or before tuberization can delay tuber growth and reduce yields.
- Potato requires high levels of available soil K. Potassium is relatively immobile in the soil. For best results, K fertilizers should be applied pre-plant and mixed into the seedbed.
- Phosphorus (P) is immobile in soil and therefore does not move from where it is placed. P fertilizers should either be mixed into the seedbed before planting or banded at planting.
- Place fertilizers close to but not in contact with seed tubers for more efficient fertilizer use.
- Use FYM 5 tonnes per acre at land preparation.

Fertilizer recommendation for vegetables

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Chilli (rainfed)	24.00	20.70	22.50	52.00	129.00	37.00	129.00	7.00	3.00
Chilli (irrigated)	28.00	27.60	30.00	61.00	173.00	50.00	173.00	1.00	4.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 top-dressings at 30 and 60 days after planting.
- **Option 2:** Apply entire suphala and SSP as a basal dressing and urea as top-dressing.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Cauliflower	40.00	27.60	36.00	87.00	173.00	60.00	173.00	27.00	14.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 30 and 60 days after planting.
- **Option 2:** Apply suphala and MoP as a basal dressing. Split the urea into 2 parts and top-dress at 30 and 60 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)									
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)			
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP	SSP
Cabbage	40.00	23.00	27.60	87.00	144.00	46.00	144.00	37.00	8.00	

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 30 and 45 days after planting.
- **Option 2:** Apply suphala and MoP as a basal dressing. Split the urea into 2 parts and top-dress at 30 and 45 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Tomato	15.00	5.75	17.25	33.00	36.00	29.00	36.00	20.00	19.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 20 and 45 days after planting.
- **Option 2:** Apply suphala, and MoP, as a basal dressing. Split the urea into 2 parts and top-dress at 20 and 45 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Time	Fertilizer Recommendations (kg/ac)									
		Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)			
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP	SSP
Asparagus 1st year 2nd year	Basal Side	20.00 80.00	35.00 48.60	16.00 90.00	43.00 174.00	219.00 300.00	27.00 149.00	100.00 300.00	9.00 70.00	70.00	119.00
Apply 2-3 tonnes of FYM /compost at transplanting. From the 2nd year, side dress fertilizer											
Beans	Basal	17.50	44.00	66.00	38.00	275.00	110.00	109.00		81.00	166.00
Apply 2-3 tonnes of FYM. Grows on wide range of soils, pH 5.5-6.8. Legume needs little N.											
Brinjal	Basal TD	20.00 20.00	30.80	13.20	43.00 43.00	86.00	22.00	83.00	15.00 43.00		3.75
Apply 4-5 tonnes of FYM. Best temperature for growth 25-30°C.TD (top-dress) 30 DAT											
Carrot	Basal	10.00	4.40	26.40	22.00	28.00	44.00	28.00	12.00	37.00	
Apply 4-5 tonnes of FYM. Needs K for proper development of roots.											

Chinese Cabbage	Basal TD1 TD2	20.00 15.00 15.00	33.00	17.60	43.00 33.00 33.00	206.00	29.00	110.00	5.00 33.00 33.00		96.25
Apply 5-6 tonnes of FYM. Requires well-drained soils, pH 6-6.8. 1st top dressing 30 DAT 2nd top dressing 60 DAT											
Cucumber	Basal TD	18.00 19.50	44.00	33.00	39.00 42.00	275.00	55.00	113.00	42.00	25.00	163.00
Apply 8-10 tonnes of FYM. Requires good moisture & FYM/OM. Loamy soils best, pH 5.5-6.8. Top dress 4-6 weeks after planting.											
Lettuce	Basal	10.00	17.60	8.80	22.00	110.00	15.00	55.00	3.00		55.00
Apply 2-3 t tonnes of FYM. Needs continuous moisture so irrigation /water source essential											
Onion	Basal TD	20.00 30.00	33.00	33.00	43.00 65.00	206.00	55.00	125.00	65.00	22.00	81.25
Apply 5 tonnes of FYM. Grows on any soil with good FYM/OM. Bulbs may be poor on heavy wet soils. Optimum pH 6.0-6.8. Top-dress 30 DAP.											
Pea	Basal	25.00	35.20	38.50	54.00	220.00	64.00	156.00		22.00	64.00
Apply 2-3 tonnes of FYM. Grows on all soils, except if waterlogged or compacted. Legume so needs little N.											
Radish	Basal	25.00	17.60	33.00	54.00	110.00	55.00	110.00	16.00	26.00	
Apply 2-3 tonnes of FYM. Grows best in light OM-rich soil pH 6.6-6.8.											
Saag and Spinach	Basal	37.50	33.00	33.00	82.00	206.00	55.00	206.00		10.00	
Apply 8-10 tonnes of FYM. Grow well in all soils; prefer well drained and adequate FYM/OM. pH 6-6.8.											
NB: TD = Top dressing; DAP = Days after planting; DAT = Days after transplanting FYM = farmyard manure; OM = Organic matter e.g. FYM, compost, leaf litter											

14.5 Haa Dzongkhag

Soil nutrient status

	pH	OM%	Total N%	AvP (mg/kg)	AvK (mg/kg)	Texture
Rating class	5.39	4.64	0.24	36.00	126.90	Clay Loam
	Very acidic	Medium	Medium	High	Medium	

The soil is very acidic (refer to lime recommendation section 5). The total nitrogen and available potassium are within the medium range, whereas the available phosphorus levels are within the low range. The organic matter is in the medium range. The soil texture is clay loam.

Fertilizer recommendation for cereals

Crop	Yield target (ton/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizer (Option 1)			Fertilizer (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Rice	2.50	56.25	5.63	37.50	122.00	35.00	62.00	35.00	110.00	53.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the top-dressed urea into 2 equal parts and apply half at 20-35 days after transplanting (DAT) at tillering stage, and the remaining half at 40-50 DAT (panicle initiation stage).
- **Option 2:** Apply the entire dose of suphala, MoP and $^1/_3$ urea as basal dressing, then top-dress the other $^1/_3$ at 20-35 DAT (tillering stage) and the remaining $^1/_3$ at 40-50 DAT (panicle initiation stage).
- Do not apply urea top-dressing when heavy rainfall is expected.
- Do not apply urea on to standing water, under windy conditions before canopy closure, or at midday when the water temperature is highest.
- When top-dressing, close the terrace water inlets and outlets for at least three days.
- Use at least 2-3 tonnes/acre of FYM at land preparation and plough or cultivate it into the soil before sowing, planting or transplanting.

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizer (Option 1)				Fertilizer (Option 2)	
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Wheat	1.20	27.60	9.00	24.00	60.00	56.00	62.00	56.00	40.00	47.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Top-dressed the other half immediately before the first irrigation, at crown root initiation stage (20-40 days after sowing depending on altitude).
- **Option 2:** Apply the entire dose of suphala and MoP as basal dressing, then top-dress the urea immediately before the first irrigation, at crown root initiation stage (20-40 days after sowing depending on altitude).
- To avoid unproductive tillering and secondary shoots, restrict nutrient supply (especially N) to early growth stages (i.e. start of tillering).
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrients			Fertilizer (Option 1)				Fertilizer (Option 2)	
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	MoP	SSP
Buckwheat	6.00	6.00	6.00	13.00	38.00	10.00	38.00		

- **Option 1:** Apply the entire dose of SSP, MoP and urea as a basal dressing.
- **Option 2:** Apply the entire dose of suphala as basal dressing.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrients			Fertilizer (Option 1)				Fertilizer (Option 2)	
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	MoP	SSP
Barley	4.50	9.00	13.00	10.00	56.00	22.00	28.00	28.00	14.00

- **Option 1:** Apply the entire dose of SSP, MoP and urea as a basal dressing.
- **Option 2:** Apply the entire dose of suphala, MoP, and SSP as basal dressing.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Maize	1.80	45.00	13.50	57.60	98.00	84.00	96.00	84.00	68.00	73.00

- **Option 1:** Apply the entire dose of SSP, MoP and $^1/_3$ urea as a basal dressing. Top-dressed $^1/_3$ urea at 35-40 days after planting (knee high stage) and the remaining $^1/_3$ at 60-70 days (tasseling stage).
- **Option 2:** Apply the entire dose of suphala, MoP as basal dressing. Top-dress half urea at 35-40 days after planting (knee high stage) and the remaining half at 60-70 days (tasseling stage).
- Use FYM 2-3 tonnes per acre at land preparation.

Fertilizer recommendation for potato

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizers (Option 1)			Fertilizers (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Potato	6.02	37.60	9.02	48.13	82.00	56.00	80.00	56.00	62.00	65.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Top-dressed half urea at earthing up when the leaves are about 10-15 cm long, or at tuber initiation.
- **Option 2:** Apply the entire dose of suphala and MoP and $^1/_3$ urea as basal dressing, then top-dress the remaining at earthing up when the leaves are about 10-15 cm long, or at tuber initiation.
- Potato uses large amounts of N, frequently more than the total applied as fertilizer. Therefore, it is advised to be applied in at least two to three spilt applications. However, excess N at or before tuberization can delay tuber growth and reduce yields.
- Potato requires high levels of available soil K. Potassium is relatively immobile in the soil. For best results, K fertilizers should be applied pre-plant and mixed into the seedbed.
- Phosphorus (P) is immobile in soil and therefore does not move from where it is placed. P fertilizers should either be mixed into the seedbed before planting or banded at planting.

- Place fertilizers close to but not in contact with seed tubers for more efficient fertilizer use.
- Use FYM 5 tonnes per acre at land preparation.

Fertilizer recommendation for vegetables

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Chilli (rainfed)	24.00	13.50	18.00	52.00	84.00	30.00	84.00	2300	7.00
Chilli (irrigated)	28.00	18.00	24.00	61.00	113.00	40.00	113.00	22.00	10.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 top-dressings at 30 and 60 days after planting.
- **Option 2:** Apply entire suphala, MoP as a basal dressing. Split urea into 2 parts and top-dress at 30 and 60 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Cauliflower	40.00	18.00	32.00	87.00	113.00	53.00	113.00	48.00	23.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 30 and 60 days after planting.
- **Option 2:** Apply suphala and MoP as a basal dressing. Split the urea into 2 parts and top-dress at 30 and 60 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)									
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)			
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP	SSP
Cabbage	40.00	15.00	24.00	87.00	94.00	40.00	94.00	54.00	15.00	

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 30 and 45 days after planting.
- **Option 2:** Apply suphala and MoP as a basal dressing. Split the urea into 2 parts and top-dress at 30 and 45 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Tomato	18.75	3.75	15.00	41.00	23.00	25.00	23.00	33.00	19.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 20 and 45 days after planting.
- **Option 2:** Apply suphala, and MoP as a basal dressing. Split the urea into 2 parts and top-dress at 20 and 45 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Time	Fertilizer Recommendations (kg/ac)									
		Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)			
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP	SSP
Asparagus 1st year 2nd year	 Basal Side	 20.00 60.00	 35.00 48.60	 16.00 90.00	 43.00 130.00	 219.00 300.00	 27.00 149.00	 100.00 300.00	 9.00 26.00	 70.00	 119.00
Apply 2-3 tonnes of FYM /compost at transplanting. From the 2nd year, side dress fertilizer											
Beans	Basal	14.00	44.00	66.00	30.00	275.00	110.00	88.00		86.00	188.00
Apply 2-3 tonnes of FYM. Grows on wide range of soils, pH 5.5-6.8. Legume needs little N.											
Brinjal	Basal TD	20.00 12.00	30.80	13.20	43.00 26.00	193.00	22.00	83.00	15.00 26.00		110.00
Apply 4-5 tonnes of FYM. Best temperature for growth 25-30°C.TD (top-dress) 30 DAT											
Carrot	Basal	8.00	4.40	26.40	17.00	28.00	44.00	28.00	8.00	37.00	
Apply 4-5 tonnes of FYM. Needs K for proper development of roots.											
Chinese Cabbage	Basal TD1 TD2	20.00 10.00 10.00	33.00	17.60	43.00 22.00 22.00	206.00	29.00	110.00	5.00 22.00 22.00		96.00
Apply 5-6 tonnes of FYM. Requires well-drained soils, pH 6-6.8. 1st top dressing 30 DAT 2nd top dressing 60 DAT											
Cucumber	Basal TD	18.00 12.00	44.00	33.00	39.00 26.00	275.00	55.00	113.00	 26.00	25.00	163.00
Apply 8-10 tonnes of FYM. Requires good moisture & FYM/OM. Loamy soils best, pH 5.5-6.8. Top dress 4-6 weeks after planting.											
Lettuce	Basal	8.0	17.60	8.80	17.00	110.00	15.00	50.00			60.00
Apply 2-3 tonnes of FYM. Needs continuous moisture so irrigation /water source essential											
Onion	Basal TD	20.00 20.00	33.00	33.00	43.00 43.00	206.00	55.00	125.00	 43.00	22.00	81.25
Apply 5 tonnes of FYM. Grows on any soil with good FYM/OM. Bulbs may be poor on heavy wet soils. Optimum pH 6.0-6.8. Top-dress 30 DAP.											
Pea	Basal	20.00	35.20	38.50	43.00	220.00	64.00	125.00		31.00	95.00
Apply 2-3 tonnes of FYM. Grows on all soils, except if waterlogged or compacted. Legume so needs little N.											
Radish	Basal	20.00	17.60	33.00	43.00	110.00	55.00	110.00	5.00	26.00	
Apply 2-3 tonnes of FYM. Grows best in light OM-rich soil pH 6.6-6.8.											
Saag and Spinach	Basal	30.00	33.00	33.00	65.00	206.00	55.00	188.00		5.00	18.00
Apply 8-10 tonnes of FYM. Grow well in all soils; prefer well drained and adequate FYM/OM. pH 6-6.8.											
NB: TD = Top dressing; DAP = Days after planting; DAT = Days after transplanting FYM = farmyard manure; OM = Organic matter e.g. FYM, compost, leaf litter											

Fertilizer recommendation for fruit plants and plantation crops

Fruit tree	Plant Nutrient	Non-Bearing trees (g/tree/yr)		Bearing trees (g/tree/yr)		Matured trees	
		Nutrient	Fertilizer (g)	Nutrient	Fertilizer (g)	Nutrient	Fertilizer (g)
Apple	N	56	122g Urea	62	135g Urea	82	178g Urea
	P_2O_5	14	88g SSP	24	150g SSP	32	200g SSP
	K_2O	75	125g MoP	110	183g MoP	135	224g MoP
		Using suphala: Apply suphala: 88g, urea: 91g and MoP: 101g		Using suphala: Apply suphala: 150g, urea: 83g and MoP: 143g		Using suphala: Apply suphala: 200g, urea 109g and MoP 171g	
	Split N application, half in December-March with full P &K, other half in June. Irrigate /moisten the soils after fertilizer application. FYM to be applied based upon availability.						

14.6 Lhuentse Dzongkhag

Soil nutrient status

	pH	OM%	Total N%	AvP (mg/kg)	AvK (mg/kg)	Texture
Rating class	5.55	3.22	0.15	20.74	103.34	Loam
	Slightly acidic	Medium	Low	Medium	Medium	

The soil is slightly acidic but adequate for most of the crop production. The organic matter, available phosphorus, and potassium levels are within the medium range. The soil contains a low level of total nitrogen, and the soil texture is loam.

Fertilizer recommendation for cereals

Crop	Yield target (ton/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizer (Option 1)			Fertilizer (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Rice	2.50	56.25	7.50	37.50	122.00	47.00	62.00	47.00	106.00	50.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the top-dressed urea into 2 equal parts and apply half at 20-35 days after transplanting (DAT) at tillering stage, and the remaining half at 40-50 DAT (panicle initiation stage).
- **Option 2:** Apply the entire dose of suphala, MoP and $^1/_3$ urea as basal dressing, then top-dress the other $^1/_3$ at 20-35 DAT (tillering stage) and the remaining $^1/_3$ at 40-50 DAT (panicle initiation stage).
- Do not apply urea top-dressing when heavy rainfall is expected.
- Do not apply urea on to standing water, under windy conditions before canopy closure, or at midday when the water temperature is highest.
- When top-dressing, close the terrace water inlets and outlets for at least three days.
- Use at least 2-3 tonnes/acre of FYM at land preparation and plough or cultivate it into the soil before sowing, planting or transplanting.

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizer (Option 1)				Fertilizer (Option 2)	
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Wheat	1.20	27.60	12.00	24.00	60.00	75.00	40.00	75.00	34.00	20.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Top-dressed the other half immediately before the first irrigation, at crown root initiation stage (20-40 days after sowing depending on altitude).
- **Option 2:** Apply the entire dose of suphala and MoP as basal dressing, then top-dress the urea immediately before the first irrigation, at crown root initiation stage (20-40 days after sowing depending on altitude).
- To avoid unproductive tillering and secondary shoots, restrict nutrient supply (especially N) to early growth stages (i.e. start of tillering).
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Maize	1.80	45.00	18.00	57.60	98.00	113.00	96.00	113.00	59.00	66.00

- **Option 1:** Apply the entire dose of SSP, MoP and $^1/_3$ urea as a basal dressing. Top-dressed $^1/_3$ urea at 35-40 days after planting (knee high stage) and the remaining $^1/_3$ at 60-70 days (tasseling stage).
- **Option 2:** Apply the entire dose of suphala, MoP as basal dressing. Top-dress half urea at 35-40 days after planting (knee high stage) and the remaining half at 60-70 days (tasseling stage).
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrients			Fertilizer (Option 1)				Fertilizer (Option 2)	
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Millet	24.00	11.00	11.00	52.00	69.00	18.00	69.00	28.00	

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing and, apply the other half urea 30-40 days after sowing
- **Option 2:** Apply the entire dose of suphala and apply urea as top-dressing 30-40 days after sowing.
- Use FYM 2-3 tonnes per acre at land preparation.

Fertilizer recommendation for potato

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizers (Option 1)			Fertilizers (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Potato	6.02	25.88	8.28	33.13	56.00	52.00	55.00	52.00	38.00	41.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Top-dressed half urea at earthing up when the leaves are about 10-15 cm long, or at tuber initiation.
- **Option 2:** Apply the entire dose of suphala and MoP and $^1/_3$ urea as basal dressing, then top-dress the remaining at earthing up when the leaves are about 10-15 cm long, or at tuber initiation.
- Potato uses large amounts of N, frequently more than the total applied as fertilizer. Therefore, it is advised to be applied in at least two to three spilt applications. However, excess N at or before tuberization can delay tuber growth and reduce yields.
- Potato requires high levels of available soil K. Potassium is relatively immobile in the soil. For best results, K fertilizers should be applied pre-plant and mixed into the seedbed.
- Phosphorus (P) is immobile in soil and therefore does not move from where it is placed. P fertilizers should either be mixed into the seedbed before planting or banded at planting.
- Place fertilizers close to but not in contact with seed tubers for more efficient fertilizer use.
- Use FYM 5 tonnes per acre at land preparation.

Fertilizer recommendation for vegetables

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Chilli (rainfed)	24.00	18.00	18.00	52.00	113.00	30.00	113.00	13.00	
Chilli (irrigated)	28.00	24.00	30.00	61.00	150.00	50.00	150.00	9.00	10.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 top-dressings at 30 and 60 days after planting.
- **Option 2:** Apply entire dose of suphala and, MoP as a basal dressing. Apply urea as top-dressing.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Cauliflower	40.00	24.00	32.00	87.00	150.00	53.00	150.00	35.00	13.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 30 and 60 days after planting.
- **Option 2:** Apply suphala and MoP as a basal dressing. Split the urea into 2 parts and top-dress at 30 and 60 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)									
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)			
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP	SSP
Cabbage	40.00	20.00	24.00	87.00	125.00	40.00	125.00	43.00	7.00	

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 30 and 45 days after planting.
- **Option 2:** Apply suphala, MoP, SSP as a basal dressing. Split the urea into 2 parts and top-dress at 30 and 45 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Tomato	18.75	5.00	15.00	41.00	31.00	25.00	31.00	30.00	17.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 20 and 45 days after planting.
- **Option 2:** Apply suphala, and MoP, as a basal dressing. Split the urea into 2 parts and top-dress at 20 and 45 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Time	Fertilizer Recommendations (kg/ac)									
		Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)			
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP	SSP
Asparagus 1st year 2nd year	Basal Side	20.00 60.00	35.00 35.00	16.00 80.00	43.00 130.00	219.00 219.00	27.00 133.00	100.00 219.00	9.00 54.00	75.00	119.00
Apply 2-3 tonnes of FYM /compost at transplanting. From the 2nd year, side dress fertilizer											
Beans	Basal	14.00	36.00	60.00	30.00	225.00	100.00	88.00		76.00	138.00
Apply 2-3 tonnes of FYM. Grows on wide range of soils, pH 5.5-6.8. Legume needs little N.											
Brinjal	Basal TD	20.00 12.00	25.00	12.00	43.00 26.00	156.00	20.00	75.00	17.00 26.00		81.00

Apply 4-5 tonnes of FYM. Best temperature for growth 25-30°C.TD (top-dress) 30 DAT											
Carrot	Basal	8.00	4.00	24.00	17.00	25.00	40.00	25.00	9.00	33.00	
Apply 4-5 tonnes of FYM. Needs K for proper development of roots.											
Chinese Cabbage	Basal TD1 TD2	20.00 10.00 10.00	27.00	16.00	43.00 22.00 22.00	169.00	27.00	100.00	9.00 22.00 22.00		69.00
Apply 5-6 tonnes of FYM. Requires well-drained soils, pH 6-6.8. 1st top dressing 30 DAT 2nd top dressing 60 DAT											
Cucumber	Basal TD	18.00 12.00	36.00	30.00	39.00 26.00	225.00	50.00	113.00	26.00	20.00	113.00
Apply 8-10 tonnes of FYM. Requires good moisture & FYM/OM. Loamy soils best, pH 5.5-6.8. Top dress 4-6 weeks after planting.											
Lettuce	Basal	8.00	14.40	8.00	17.00	90.00	13.00	50.00		40.00	
Apply 2-3 tonnes of FYM. Needs continuous moisture so irrigation /water source essential											
Onion	Basal TD	20.00 20.00	27.00	30.00	43.00 43.00	169.00	50.00	125.00	43.00	17.00	44.00
Apply 5 tonnes of FYM. Grows on any soil with good FYM/OM. Bulbs may be poor on heavy wet soils. Optimum pH 6.0-6.8. Top-dress 30 DAP.											
Pea	Basal	20.00	28.80	35.00	43.00	180.00	58.00	125.00		25.00	55.00
Apply 2-3 tonnes of FYM. Grows on all soils, except if waterlogged or compacted. Legume so needs little N.											
Radish	Basal	20.00	14.40	30.00	43.00	90.00	50.00	90.00	12.00	26.00	
Apply 2-3 tonnes of FYM. Grows best in light OM-rich soil pH 6.6-6.8.											
Saag and Spinach	Basal	30.00	27.00	30.00	65.00	169.00	50.00	167.00	7.00	5.00	
Apply 8-10 tonnes of FYM. Grow well in all soils; prefer well drained and adequate FYM/OM. pH 6-6.8.											
NB: TD = Top dressing; DAP = Days after planting; DAT = Days after transplanting FYM = farmyard manure; OM = Organic matter e.g. FYM, compost, leaf litter											

Fertilizer recommendation for fruit plants and plantation crops

Fruit tree	Plant Nutrient	Non-Bearing trees (g/tree/yr)		Bearing trees (g/tree/yr)	
		Nutrient	Fertilizer	Nutrient	Fertilizer
Citrus	N	75	163g Urea	200	435g Urea
	P_2O_5	25	156g SSP	50	313g SSP
	K_2O	125	208g MoP	300	498g MoP
		Using suphala: Apply suphala: 156g, urea 109g and MoP: 166.00g		Using suphala: apply suphala: 313g, urea: 326g and MoP: 415g	
	Fertilizer application: After harvest & prior to spring flush. FYM to be applied based upon availability				

14.7 Mongar Dzongkhag

Soil nutrient status

	pH	OM%	Total N%	AvP (mg/kg)	AvK (mg/kg)	Texture
Rating class	5.85	3.89	0.17	15.00	129.00	Silty Clay Loam
	Slightly acidic	Medium	Low	Medium	Medium	

The soil is slightly acidic but adequate for the production of most crops. The organic matter, available phosphorus, and potassium levels are within the medium range, whereas the total nitrogen is within the low range. The soil texture is silty clay loam.

Fertilizer recommendation for cereals

Crop	Yield target (ton/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizer (Option 1)			Fertilizer (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Rice	2.50	56.25	7.50	38.00	122.00	47.00	63.00	47.00	106.00	51.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the top-dressed urea into 2 equal parts and apply half at 20-35 days after transplanting (DAT) at tillering stage, and the remaining half at 40-50 DAT (panicle initiation stage).
- **Option 2:** Apply the entire dose of suphala, MoP and $^1/_3$ urea as basal dressing, then top-dress the other $^1/_3$ at 20-35 DAT (tillering stage) and the remaining $^1/_3$ at 40-50 DAT (panicle initiation stage).
- Do not apply urea top-dressing when heavy rainfall is expected.
- Do not apply urea on to standing water, under windy conditions before canopy closure, or at midday when the water temperature is highest.
- When top-dressing, close the terrace water inlets and outlets for at least three days.
- Use at least 2-3 tonnes/acre of FYM at land preparation and plough or cultivate it into the soil before sowing, planting or transplanting.

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizer (Option 1)				Fertilizer (Option 2)	
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Wheat	1.20	30.36	12.00	24.00	66.00	75.00	40.00	75.00	40.00	20.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Top-dressed the other half immediately before the first irrigation, at crown root initiation stage (20-40 days after sowing depending on altitude).
- **Option 2:** Apply the entire dose of suphala and MoP as basal dressing, then top-dress the urea immediately before the first irrigation, at crown root initiation stage (20-40 days after sowing depending on altitude).
- To avoid unproductive tillering and secondary shoots, restrict nutrient supply (especially N) to early growth stages (i.e. start of tillering).
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrients			Fertilizer (Option 1)				Fertilizer (Option 2)	
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	MoP	SSP
Buckwheat	6.00	10.00	6.00	13.00	63.00	10.00	38.00		25.00

- **Option 1:** Apply the entire dose of SSP, MoP and urea as a basal dressing.
- **Option 2:** Apply the entire dose of suphala and SSP as basal dressing.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrients			Fertilizer (Option 1)				Fertilizer (Option 2)	
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	MoP	SSP
Barley	4.50	13.00	13.00	10.00	81.00	22.00	28.00	14.00	53.00

- **Option 1:** Apply the entire dose of SSP, MoP and urea as a basal dressing.
- **Option 2:** Apply the entire dose of suphala, MoP and SSP as basal dressing.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrients			Fertilizer (Option 1)				Fertilizer (Option 2)	
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Millet	24.00	11.00	11.00	52.00	69.00	18.00	69.00	28.00	

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing and, apply the other half urea 30-40 days after sowing
- **Option 2:** Apply the entire dose of suphala and MoP and, apply urea as top-dressing 30-40 days after sowing.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Maize	1.80	49.50	18.00	57.60	108.00	113.00	96.00	113.00	68.00	56.00

- **Option 1:** Apply the entire dose of SSP, MoP and $^1/_3$ urea as a basal dressing. Top-dressed $^1/_3$ urea at 35-40 days after planting (knee high stage) and the remaining $^1/_3$ at 60-70 days (tasseling stage).
- **Option 2:** Apply the entire dose of suphala, MoP as basal dressing. Top-dress half urea at 35-40 days after planting (knee high stage) and the remaining half at 60-70 days (tasseling stage).
- Use FYM 2-3 tonnes per acre at land preparation.

Fertilizer recommendation for potato

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizers (Option 1)			Fertilizers (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Potato	4.00	25.00	8.00	32.00	54.00	50.00	53.00	50.00	37.00	40.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Top-dressed half urea at earthing up when the leaves are about 10-15 cm long, or at tuber initiation.
- **Option 2:** Apply the entire dose of suphala and MoP and $^1/_3$ urea as basal dressing, then top-dress the remaining at earthing up when the leaves are about 10-15 cm long, or at tuber initiation.
- Potato uses large amounts of N, frequently more than the total applied as fertilizer. Therefore, it is advised to be applied in at least two to three spilt applications. However, excess N at or before tuberization can delay tuber growth and reduce yields.

- Potato requires high levels of available soil K. Potassium is relatively immobile in the soil. For best results, K fertilizers should be applied pre-plant and mixed into the seedbed.
- Phosphorus (P) is immobile in soil and therefore does not move from where it is placed. P fertilizers should either be mixed into the seedbed before planting or banded at planting.
- Place fertilizers close to but not in contact with seed tubers for more efficient fertilizer use.
- Use FYM 5 tonnes per acre at land preparation.

Fertilizer recommendation for vegetables

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Chilli (rainfed)	27.60	18.00	18.00	60.00	113.00	30.00	113.00	21.00	
Chilli (irrigated)	32.20	24.00	24.00	70.00	150.00	40.00	150.00	18.00	

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 top-dressings at 30 and 60 days after planting.
- **Option 2:** Apply entire suphala as a basal dressing. Split the urea and top-dressed urea at 30 and 60 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Cauliflower	46.00	27.60	40.00	100.00	173.00	66.00	173.00	40.00	21.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 30 and 60 days after planting.
- **Option 2:** Apply suphala and MoP as a basal dressing. Split the urea into 2 parts and top-dress at 30 and 60 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)									
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)			
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP	SSP
Cabbage	46.00	20.00	30.00	100.00	125.00	50.00	125.00	57.00	17.00	

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 30 and 45 days after planting.
- **Option 2:** Apply suphala, MoP, SSP as a basal dressing. Split the urea into 2 parts and top-dress at 30 and 45 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Tomato	22.50	5.75	18.75	49.00	36.00	31.00	36.00	36.00	22.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 20 and 45 days after planting.
- **Option 2:** Apply suphala, and MoP, as a basal dressing. Split the urea into 2 parts and top-dress at 20 and 45 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Time	Fertilizer Recommendations (kg/ac)									
		Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)			
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP	SSP
Asparagus 1st year 2nd year	Basal Side	40.00 60.00	40.00 35.00	16.00 80.00	87.00 130.00	250.00 219.00	27.00 133.00	100.00 219.00	52.00 54.00	 75.00	150.00
Apply 2-3 tonnes of FYM /compost at transplanting. From the 2nd year, side dress fertilizer											
Beans	Basal	17.50	40.00	66.00	38.00	250.00	110.00	109.00		81.00	141.00
Apply 2-3 tonnes of FYM. Grows on wide range of soils, pH 5.5-6.8. Legume needs little N.											
Brinjal	Basal TD	20.00 20.00	28.00	13.20	43.00 43.00	175.00	22.00	83.00	15.00 43.00		93.00
Apply 4-5 tonnes of FYM. Best temperature for growth 25-30°C.TD (top-dress) 30 DAT											
Carrot	Basal	10.00	4.00	26.40	22.00	25.00	44.00	25.00	13.00	37.00	
Apply 4-5 tonnes of FYM. Needs K for proper development of roots.											
Chinese Cabbage	Basal TD1 TD2	20.00 10.00 10.00	30.00	17.60	43.00 22.00 22.00	188.00	29.00	110.00	5.00 22.00 22.00		78.00
Apply 5-6 tonnes of FYM. Requires well-drained soils, pH 6-6.8. 1st top dressing 30 DAT 2nd top dressing 60 DAT											
Cucumber	Basal TD	18.00 19.00	40.00	33.00	39.00 41.00	250.00	55.00	113.00	 41.00	25.00	138.00
Apply 8-10 tonnes of FYM. Requires good moisture & FYM/OM. Loamy soils best, pH 5.5-6.8. Top dress 4-6 weeks after planting.											
Lettuce	Basal	10.00	16.00	8.80	22.00	100.00	15.00	55.00	3.00		45.00
Apply 2-3 tonnes of FYM. Needs continuous moisture so irrigation /water source essential											
Onion	Basal TD	20.00 30.00	30.00	33.00	43.00 65.00	188.00	55.00	125.00	 65.00	22.00	63.00
Apply 5 tonnes of FYM. Grows on any soil with good FYM/OM. Bulbs may be poor on heavy wet soils. Optimum pH 6.0-6.8. Top-dress 30 DAP.											
Pea	Basal	25.00	32.00	38.50	54.00	200.00	64.00	157.00		22.00	44.00
Apply 2-3 tonnes of FYM. Grows on all soils, except if waterlogged or compacted. Legume so needs little N.											
Radish	Basal	25.00	16.00	33.00	54.00	100.00	55.00	100.00	20.00	28.00	
Apply 2-3 tonnes of FYM. Grows best in light OM-rich soil pH 6.6-6.8.											
Saag and Spinach	Basal	30.00	27.00	30.00	65.00	169.00	50.00	169.00	7.00	5.00	
Apply 8-10 tonnes of FYM. Grow well in all soils; prefer well drained and adequate FYM/OM. pH 6-6.8.											
NB: TD = Top dressing; DAP = Days after planting; DAT = Days after transplanting FYM = farmyard manure; OM = Organic matter e.g. FYM, compost, leaf litter											

Fertilizer recommendation for fruit plants and plantation crops

Fruit tree	Plant Nutrient	Non-Bearing trees (g/tree/yr)		Bearing trees (g/tree/yr)	
		Nutrient	Fertilizer	Nutrient	Fertilizer
Citrus	N	100	217g Urea	250	544g Urea
	P_2O_5	50	313g SSP	100	625g SSP
	K_2O	150	249g MoP	350	581g MoP
		Using suphala: Apply suphala: 313g, urea 109g and MoP: 166.00g		Using suphala: apply suphala: 625g, urea: 326g and MoP: 415g	
	Fertilizer application: After harvest & prior to spring flush. FYM to be applied based upon availability				

14.8 Paro Dzongkhag

Soil nutrient status

	pH	OM%	Total N%	AvP (mg/kg)	AvK (mg/kg)	Texture
Rating class	5.63	3.25	0.27	31.00	90.00	Loam
	Slightly acidic	Medium	Medium	High	Low	

The soil is slightly acidic, within the tolerable range for most of the agricultural crop production. The organic matter and total nitrogen are within the medium range. The available potassium is within the low range, whereas the available phosphorus is in the high range. The soil texture is loam.

Fertilizer recommendation for cereals

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizers (Option 1)			Fertilizers (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Rice (Local)		28.00	6.75	16.00	61.00	42.00	27.00	42.00	46.00	15.00
Rice (Improved)	2.50	45.00	6.75	41.25	98.00	42.00	68.00	42.00	83.00	57.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the top-dressed urea into 2 equal parts and apply half at 20-35 days after transplanting (DAT) at tillering stage, and the remaining half at 40-50 DAT (panicle initiation stage).
- **Option 2:** Apply the entire dose of suphala, MoP and $^1/_3$ urea as basal dressing, then top-dress the other $^1/_3$ at 20-35 DAT (tillering stage) and the remaining $^1/_3$ at 40-50 DAT (panicle initiation stage).
- Do not apply urea top-dressing when heavy rainfall is expected.
- Do not apply urea on to standing water, under windy conditions before canopy closure, or at midday when the water temperature is highest.
- When top-dressing, close the terrace water inlets and outlets for at least three days.
- Use at least 2-3 tonnes/acre of FYM at land preparation and plough or cultivate it into the soil before sowing, planting or transplanting.

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizer (Option 1)				Fertilizer (Option 2)	
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Wheat	1.20	30.36	10.80	26.40	66.00	68.00	44.00	68.00	43.00	26.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Top-dressed the other half immediately before the first irrigation, at crown root initiation stage (20-40 days after sowing depending on altitude).
- **Option 2:** Apply the entire dose of suphala and MoP as basal dressing, then top-dress the urea immediately before the first irrigation, at crown root initiation stage (20-40 days after sowing depending on altitude).
- To avoid unproductive tillering and secondary shoots, restrict nutrient supply (especially N) to early growth stages (i.e. start of tillering).
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrients			Fertilizer (Option 1)				Fertilizer (Option 2)	
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	MoP	SSP
Barley	9.00	9.00	9.00	20.00	56.00	15.00	56.00		

- **Option 1:** Apply the entire dose of SSP, MoP and urea as a basal dressing.
- **Option 2:** Apply the entire dose of suphala as basal dressing.
- Use FYM 2-3 tonnes per acre at land preparation.

Fertilizer recommendation for potato

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizers (Option 1)			Fertilizers (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Potato	6.00	37.50	10.20	55.20	82.00	64.00	92.00	64.00	59.00	75.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Top-dressed half urea at earthing up when the leaves are about 10-15 cm long, or at tuber initiation.
- **Option 2:** Apply the entire dose of suphala and MoP and $^1/_3$ urea as basal dressing, then top-dress the remaining at earthing up when the leaves are about 10-15 cm long, or at tuber initiation.
- Potato uses large amounts of N, frequently more than the total applied as fertilizer. Therefore, it is advised to be applied in at least two to three spilt applications. However, excess N at or before tuberization can delay tuber growth and reduce yields.
- Potato requires high levels of available soil K. Potassium is relatively immobile in the soil. For best results, K fertilizers should be applied pre-plant and mixed into the seedbed.
- Phosphorus (P) is immobile in soil and therefore does not move from where it is placed. P fertilizers should either be mixed into the seedbed before planting or banded at planting.
- Place fertilizers close to but not in contact with seed tubers for more efficient fertilizer use.
- Use FYM 5 tonnes per acre at land preparation.

Fertilizer recommendation for mustard

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrients			Fertilizers (Option 1)			Fertilizers (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Mustard	20.00	9.00	11.50	43.00	56.00	19.00	56.00	24.00	4.00

- **Option 1:** Apply the entire dose of SSP, MoP and urea as a basal dressing.
- **Option 2:** Apply the entire dose of suphala, MoP, and urea as basal dressing.

Fertilizer recommendation for vegetables

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Chilli (rainfed)	27.60	13.50	22.50	69.00	84.00	37.00	84.00	31.00	15.00
Chilli (irrigated)	32.20	18.00	30.00	70.00	113.00	50.00	113.00	31.00	20.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 top-dressings at 30 and 60 days after planting.
- **Option 2:** Apply entire suphala as a basal dressing.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Cauliflower	40.00	20.40	32.00	87.00	128.00	53.00	128.00	43.00	19.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 30 and 60 days after planting.
- **Option 2:** Apply suphala and MoP as a basal dressing. Split the urea into 2 parts and top-dress at 30 and 60 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)									
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)			
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP	SSP
Cabbage	40.00	17.00	27.60	87.00	106.00	46.00	106.00	50.00	18.00	

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 30 and 45 days after planting.
- **Option 2:** Apply suphala, MoP, SSP as a basal dressing. Split the urea into 2 parts and top-dress at 30 and 45 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Tomato	15.00	4.25	17.25	33.00	27.00	29.00	27.00	23.00	22.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 20 and 45 days after planting.
- **Option 2:** Apply suphala, and MoP, as a basal dressing. Split the urea into 2 parts and top-dress at 20 and 45 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Time	Fertilizer Recommendations (kg/ac)									
		Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)			
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP	SSP
Asparagus 1st year 2nd year	 Basal Side	 40.00 60.00	 30.00 35.00	 26.00 80.00	 87.00 130.00	 188.00 219.00	 43.00 133.00	 163.00 219.00	 30.00 54.00	 75.00	25.00
Apply 2-3 tonnes of FYM /compost at transplanting. From the 2nd year, side dress fertilizer											
Beans	Basal	17.50	36.00	66.00	38.00	225.00	110.00	109.00		81.00	116.00
Apply 2-3 tonnes of FYM. Grows on wide range of soils, pH 5.5-6.8. Legume needs little N.											
Brinjal	Basal TD	20.00 20.00	25.00	12.00	43.00	156.00	20.00	75.00	17.00 43.00		81.00

Apply 4-5 tonnes of FYM.TD 30 DAT											
Carrot	Basal	10.00	4.00	26.40	22.00	25.00	44.00	25.00	13.00	37.00	
Apply 4-5 tonnes of FYM. Needs K for proper development of roots.											
Chinese Cabbage	Basal TD1 TD2	20.00 20.00 10.00	27.00	17.60	43.00 43.00 22.00	169.00	29.00	110.00	5.00 43.00 22.00		59.00
Apply 5-6 tonnes of FYM. Requires well-drained soils, pH 6-6.8. 1st top dressing 30 DAT 2nd top dressing 60 DAT											
Cucumber	Basal TD	20.00 18.00	36.00	33.00	43.00 39.00	225.00	55.00	125.00	39.00	22.00	100.00
Apply 8-10 tonnes of FYM. Requires good moisture & FYM/OM. Loamy soils best, pH 5.5-6.8. Top dress 4-6 weeks after planting.											
Lettuce	Basal	10.00	14.40	8.80	22.00	90.00	15.00	55.00	3.00		35.00
Apply 2-3 tonnes of FYM. Needs continuous moisture so irrigation /water source essential											
Onion	Basal TD	25.00 25.00	27.00	33.00	54.00 54.00	169.00	55.00	156.00	54.00	13.00	13.00
Apply 5 tonnes of FYM. Grows on any soil with good FYM/OM. Bulbs may be poor on heavy wet soils. Optimum pH 6.0-6.8. Top-dress 30 DAP.											
Pea	Basal	25.00	28.80	38.50	54.00	180.00	64.00	156.00		22.00	24.00
Apply 2-3 tonnes of FYM. Grows on all soils, except if waterlogged or compacted. Legume so needs little N.											
Radish	Basal	25.00	14.40	33.00	54.00	90.00	55.00	90.00	23.00	31.00	
Apply 2-3 tonnes of FYM. Grows best in light OM-rich soil pH 6.6-6.8.											
Saag and Spinach	Basal	37.50	27.00	33.00	82.00	169.00	55.00	169	23.00	10.00	
Apply 8-10 tonnes of FYM. Grow well in all soils; prefer well drained and adequate FYM/OM. pH 6-6.8.											
NB: TD = Top dressing; DAP = Days after planting; DAT = Days after transplanting FYM = farmyard manure; OM = Organic matter e.g. FYM, compost, leaf litter											

Fertilizer recommendation for fruit plants and plantation crops

Pome fruits	Plant Nutrient	Non-Bearing trees (g/ tree/yr)		Bearing trees (g/ tree/yr)		Matured trees	
		Nutrient	Fertilizer	Nutrient	Fertilizer	Nutrient	Fertilizer (g)
Apple Pear	N	69	150g Urea	72	157g Urea	92	200g Urea
	P_2O_5	16	100g SSP	28	175g SSP	40	250g SSP
	K_2O	90	149g MoP	120	199g MoP	150	249g MoP
	Using suphala: Apply suphala: 100g, urea: 115g and MoP: 123g			Using suphala; Apply suphala: 175g, urea: 96g and MoP: 153g		Using suphala: Apply suphala: 250g, urea: 113g and MoP: 183g	
	Using single fertilizer split N application, half in December-February with full P &K, other half in June. Irrigate /moisten the soils after fertilizer application. Using suphala, apply entire amount of fertilizer in December-February. FYM to be applied based upon availability.						

Stone fruits	Plant Nutrient	Non-Bearing trees (g/tree/yr)		Bearing trees (g/tree/yr)	
		Nutrient	Fertilizer	Nutrient	Fertilizer
Peach Plum Apricot Almond Cherry	N	60	130g Urea	80	174g Urea
	P_2O_5	42	263g SSP	42	263g SSP
	K_2O	100	166g MoP	120	199g MoP
	Using suphala: Apply suphala: 263g, urea: 39g and MoP: 96g			Using Suphala: Apply suphala: 263g, urea: 83g and MoP: 129g	
	Using single fertilizer split N application, half in December-February with full P &K, others half in June. Irrigate /moisten the soils after fertilizer application. Using suphala, apply entire quantity of fertilizer in December-February. FYM to be applied based upon availability.				

14.9 Pemagatshel Dzongkhag

Soil nutrient status

	pH	OM%	Total N%	AvP (mg/kg)	AvK (mg/kg)	Texture
Rating class	5.44	3.50	0.14	17.13	60.86	Loam
	Very acidic	Medium	Low	Medium	Low	

The soil is very acidic (refer to lime recommendation section 5). The organic matter and available phosphorus levels are within the medium range, whereas the total nitrogen and available potassium are in the low range. The soil texture is loam.

Fertilizer recommendation for cereals

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizers (Option 1)			Fertilizers (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Rice	2.00	45.00	6.00	37.50	98.00	38.00	62.00	38.00	85.00	52.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the top-dressed urea into 2 equal parts and apply half at 20-35 days after transplanting (DAT) at tillering stage, and the remaining half at 40-50 DAT (panicle initiation stage).
- **Option 2:** Apply the entire dose of suphala, MoP and $^1/_3$ urea as basal dressing, then top-dress the other $^1/_3$ at 20-35 DAT (tillering stage) and the remaining $^1/_3$ at 40-50 DAT (panicle initiation stage).
- Do not apply urea top-dressing when heavy rainfall is expected.
- Do not apply urea on to standing water, under windy conditions before canopy closure, or at midday when the water temperature is highest.
- When top-dressing, close the terrace water inlets and outlets for at least three days.
- Use at least 2-3 tonnes/acre of FYM at land preparation and plough or cultivate it into the soil before sowing, planting or transplanting.

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizer (Option 1)				Fertilizer (Option 2)	
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Wheat	1.20	30.36	12.00	30.00	66.00	75.00	50.00	75.00	40.00	30.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Top-dressed the other half immediately before the first irrigation, at crown root initiation stage (20-40 days after sowing depending on altitude).
- **Option 2:** Apply the entire dose of suphala and MoP as basal dressing, then top-dress the urea immediately before the first irrigation, at crown root initiation stage (20-40 days after sowing depending on altitude).
- To avoid unproductive tillering and secondary shoots, restrict nutrient supply (especially N) to early growth stages (i.e. start of tillering).
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrients			Fertilizer (Option 1)				Fertilizer (Option 2)	
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	MoP	SSP
Buckwheat	6.00	10.00	8.00	13.00	63.00	13.00	38.00	3.00	25.00

- **Option 1:** Apply the entire dose of SSP, MoP and urea as a basal dressing.
- **Option 2:** Apply the entire dose of suphala, MoP and SSP as basal dressing.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrients			Fertilizer (Option 1)				Fertilizer (Option 2)	
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	MoP	SSP
Barley	4.50	13.00	18.00	10.00	81.00	30.00	28.00	22.00	53.00

- **Option 1:** Apply the entire dose of SSP, MoP and urea as a basal dressing.
- **Option 2:** Apply the entire dose of suphala, MoP, and SSP as basal dressing.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrients			Fertilizer (Option 1)				Fertilizer (Option 2)	
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Millet	24.00	11.00	12.00	52.00	69.00	20.00	69.00	28.00	2.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing and, apply the other half urea 30-40 days after sowing
- **Option 2:** Apply the entire dose of suphala and MoP and, apply urea as top-dressing 30-40 days after sowing.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Maize	1.80	49.50	18.00	66.24	108.00	113.00	110.00	113.00	68.00	80.00

- **Option 1:** Apply the entire dose of SSP, MoP and $^1/_3$ urea as a basal dressing. Top-dressed $^1/_3$ urea at 35-40 days after planting (knee high stage) and the remaining $^1/_3$ at 60-70 days (tasseling stage).
- **Option 2:** Apply the entire dose of suphala, MoP as basal dressing. Top-dress half urea at 35-40 days after planting (knee high stage) and the remaining half at 60-70 days (tasseling stage).
- Use FYM 2-3 tonnes per acre at land preparation.

Fertilizer recommendation for potato

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizers (Option 1)			Fertilizer (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Potato	6.00	28.51	9.12	45.62	62.00	57.00	76.00	57.00	42.00	61.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Top-dressed half urea at earthing up when the leaves are about 10-15 cm long, or at tuber initiation.
- **Option 2:** Apply the entire dose of suphala and MoP and $^1/_3$ urea as basal dressing, then top-dress the remaining at earthing up when the leaves are about 10-15 cm long, or at tuber initiation.
- Potato uses large amounts of N, frequently more than the total applied as fertilizer. Therefore, it is advised to be applied in at least two to three spilt applications. However, excess N at or before tuberization can delay tuber growth and reduce yields.
- Potato requires high levels of available soil K. Potassium is relatively immobile in the soil. For best results, K fertilizers should be applied pre-plant and mixed into the seedbed.
- Phosphorus (P) is immobile in soil and therefore does not move from where it is placed. P fertilizers should either be mixed into the seedbed before planting or banded at planting.
- Place fertilizers close to but not in contact with seed tubers for more efficient fertilizer use.
- Use FYM 5 tonnes per acre at land preparation.

Fertilizer recommendation for vegetables

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Chilli (rainfed)	27.60	18.00	22.50	60.00	113.00	37.00	113.00	21.00	7.00
Chilli (irrigated)	32.20	24.00	30.00	70.00	150.00	50.00	150.00	18.00	10.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 top-dressings at 30 and 60 days after planting.
- **Option 2:** Apply entire Suphala and MoP as a basal dressing. Split the urea into 2 top-dressings and apply at 30 and 60 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Cauliflower	46.00	24.00	40.00	100.00	150.00	66.00	150.00	48.00	27.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half Urea into 2 parts and top-dress at 30 and 60 days after planting.
- **Option 2:** Apply suphala and MoP as a basal dressing. Split the urea into 2 parts and top-dress at 30 and 60 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)									
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)			
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP	SSP
Cabbage	46.00	20.00	30.00	100.00	125.00	50.00	125.00	57.00	17.00	

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 30 and 45 days after planting.
- **Option 2:** Apply suphala and MoP as a basal dressing. Split the urea into 2 parts and top-dress at 30 and 45 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Tomato	22.50	5.00	18.75	48.00	31.00	31.00	31.00	37.00	23.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 20 and 45 days after planting.
- **Option 2:** Apply suphala, and MoP, as a basal dressing. Split the urea into 2 parts and top-dress at 20 and 45 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Time	Fertilizer Recommendations (kg/ac)									
		Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)			
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP	SSP
Asparagus 1st year 2nd year	 Basal Side	 40.00 60.00	 30.00 46.00	 26.00 80.00	 87.00 130.00	 188.00 288.00	 43.00 133.00	 163.00 289.00	 30.00 30.00	 56.00	25.00
Apply 2-3 tonnes of FYM /compost at transplanting. From the 2nd year, side dress fertilizer											
Beans	Basal	17.50	40.00	66.00	38.00	250.00	110.00	109.00		81.00	141.00
Apply 2-3 tonnes of FYM. Grows on wide range of soils, pH 5.5-6.8. Legume needs little N.											
Brinjal	Basal TD	20.00 20.00	28.00	13.20	43.00 43.00	175.00	22.00	83.00	15.00 43.00		93.00
Apply 4-5 tonnes of FYM.TD 30 DAT											
Carrot	Basal	10.00	4.00	26.40	22.00	25.00	44.00	25.00	13.00	37.00	
Apply 4-5 tonnes of FYM. Needs K for proper development of roots.											
Chinese Cabbage	Basal TD1 TD2	20.00 20.00 10.00	30.00	17.60	43.00 43.00 22.00	188.00	29.00	110.00	5.00 43.00 22.00		78.00
Apply 5-6 tonnes of FYM. Requires well-drained soils, pH 6-6.8. 1st top dressing 30 DAT 2nd top dressing 60 DAT											
Cucumber	Basal TD	20.00 18.00	40.00	33.00	43.00 39.00	250.00	55.00	125.00	 39.00	22.00	125.00
Apply 8-10 tonnes of FYM. Requires good moisture & FYM/OM. Loamy soils best, pH 5.5-6.8. Top dress 4-6 weeks after planting.											
Lettuce	Basal	10.00	16.00	8.80	22.00	100.00	15.00	55.00	3.00		45.00
Apply 2-3 tonnes of FYM. Needs continuous moisture so irrigation /water source essential											
Onion	Basal TD	25.00 25.00	30.00	33.00	54.00 54.00	188.00	55.00	157.00	 54.00	13.00	31.00
Apply 5 tonnes of FYM. Grows on any soil with good FYM/OM. Bulbs may be poor on heavy wet soils. Optimum pH 6.0-6.8. Top-dress 30 DAP.											
Pea	Basal	25.00	32.00	38.50	54.00	200.00	64.00	157		22.00	44.00
Apply 2-3 tonnes of FYM. Grows on all soils, except if waterlogged or compacted. Legume so needs little N.											
Radish	Basal	25.00	16.00	33.00	54.00	100.00	55.00	100.00	20.00	28.00	
Apply 2-3 tonness of FYM. Grows best in light OM-rich soil pH 6.6-6.8.											
Saag and Spinach	Basal	37.50	30.00	33.00	82.00	188.00	55.00	188.00	16.00	5.00	
Apply 8-10 tonnes of FYM. Grow well in all soils; prefer well drained and adequate FYM/OM. pH 6-6.8.											
NB: TD = Top dressing; DAP = Days after planting; DAT = Days after transplanting FYM = farmyard manure; OM = Organic matter e.g. FYM, compost, leaf litter											

Fertilizer recommendation for fruit plants and plantation crops

Fruit tree	Plant Nutrient	Non-Bearing trees (g/tree/yr)		Bearing trees (g/tree/yr)	
		Nutrient	Fertilizer	Nutrient	Fertilizer
Citrus	N	100	217g Urea	250	544g Urea
	P_2O_5	35	219g SSP	75	469g SSP
	K_2O	150	249g MoP	350	581g MoP
		Using suphala: Apply suphala: 219g, urea 141g and MoP: 191g		Using suphala: apply suphala: 469g, urea: 380g and MoP: 457g	
	Fertilizer application: After harvest & prior to spring flush. FYM to be applied based upon availability				

14.10 Punakha Dzongkhag

Soil nutrient status

	pH	OM%	Total N%	AvP (mg/kg)	AvK (mg/kg)	Texture
Rating class	5.89	2.03	0.11	6.54	49.14	Sandy Loam
	Slightly Acidic	Medium	Low	Low	Low	

The soil pH is slightly acidic, optimum for the growth of most agricultural crops. All three soil parameters, total nitrogen, available phosphorus, and potassium levels, are within the low range, whereas the organic matter level is within the medium range. The soil texture is sandy loam.

Fertilizer recommendation for cereals

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizers (Option 1)			Fertilizers (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Rice (Local)		28.00	9.38	14.00	61.00	59.00	23.00	59.00	40.00	8.00
Rice (Improved)	2.50	56.25	9.38	46.88	122.00	59.00	78.00	59.00	102.00	62.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the top-dressed urea into 2 equal parts and apply half at 20-35 days after transplanting (DAT) at tillering stage, and the remaining half at 40-50 DAT (panicle initiation stage).
- **Option 2:** Apply the entire dose of suphala, MoP and $^1/_3$ urea as basal dressing, then top-dress the other $^1/_3$ at 20-35 DAT (tillering stage) and the remaining $^1/_3$ at 40-50 DAT (panicle initiation stage).
- Do not apply urea top-dressing when heavy rainfall is expected.
- Do not apply urea on to standing water, under windy conditions before canopy closure, or at midday when the water temperature is highest.
- When top-dressing, close the terrace water inlets and outlets for at least three days.
- Use at least 5 tonnes/acre of FYM at land preparation and plough or cultivate it into the soil before sowing, planting or transplanting.

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizer (Option 1)				Fertilizer (Option 2)	
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Wheat	1.20	30.36	15.00	31.20	64.00	94.00	52.00	94.00	33.00	27.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Top-dressed the other half immediately before the first irrigation, at crown root initiation stage (20-40 days after sowing depending on altitude).
- **Option 2:** Apply the entire dose of suphala and MoP as basal dressing, then top-dress the urea immediately before the first irrigation, at crown root initiation stage (20-40 days after sowing depending on altitude).
- To avoid unproductive tillering and secondary shoots, restrict nutrient supply (especially N) to early growth stages (i.e. start of tillering).
- Use FYM 5 tonnes per acre at land preparation.

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Maize	1.80	49.50	22.50	66.24	108.00	141.00	110.00	141.00	59.00	73.00

- **Option 1:** Apply the entire dose of SSP, MoP and $^1/_3$ urea as a basal dressing. Top-dressed $^1/_3$ urea at 35-40 days after planting (knee high stage) and the remaining $^1/_3$ at 60-70 days (tasseling stage).
- **Option 2:** Apply the entire dose of suphala, MoP as basal dressing. Top-dress half urea at 35-40 days after planting (knee high stage) and the remaining half at 60-70 days (tasseling stage).
- Use FYM 5 tonnes per acre at land preparation.

Fertilizer recommendation for potato

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizers (Option 1)			Fertilizers (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Potato	4.49	28.04	11.22	44.86	61.00	70.00	74.00	70.00	37.00	56.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Top-dressed half urea at earthing up when the leaves are about 10-15 cm long, or at tuber initiation.
- **Option 2:** Apply the entire dose of suphala and MoP and $^1/_3$ urea as basal dressing, then top-dress the remaining at earthing up when the leaves are about 10-15 cm long, or at tuber initiation.
- Potato uses large amounts of N, frequently more than the total applied as fertilizer. Therefore, it is advised to be applied in at least two to three spilt applications. However, excess N at or before tuberization can delay tuber growth and reduce yields.
- Potato requires high levels of available soil K. Potassium is relatively immobile in the soil. For best results, K fertilizers should be applied pre-plant and mixed into the seedbed.
- Phosphorus (P) is immobile in soil and therefore does not move from where it is placed. P fertilizers should either be mixed into the seedbed before planting or banded at planting.
- Place fertilizers close to but not in contact with seed tubers for more efficient fertilizer use.
- Use FYM 5 tonnes per acre at land preparation.

Fertilizer recommendation for mustard

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrients			Fertilizers (Option 1)			Fertilizers (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Mustard	25.00	12.50	12.50	54.00	78.00	21.00	78.00	27.00	

- **Option 1:** Apply the entire dose of SSP, MoP and urea as a basal dressing.
- **Option 2:** Apply the entire dose of suphala and urea as basal dressing.

Fertilizer recommendation for vegetables

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Chilli (rainfed)	27.60	20.70	22.50	60.00	129.00	37.00	129.00	15.00	3.00
Chilli (irrigated)	32.20	27.60	30.00	70.00	173.00	50.00	173.00	10.00	4.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 top-dressings at 30 and 60 days after planting.
- **Option 2:** Apply entire suphala and MoP as a basal dressing and top-dressed urea at 30 days after planting.
- Use FYM 5 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Cauliflower	46.00	27.60	40.00	100.00	173.00	66.00	173.00	40.00	21.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 30 and 60 days after planting.
- **Option 2:** Apply suphala and MoP as a basal dressing. Split the urea into 2 parts and top-dress at 30 and 60 days after planting.
- Use FYM 5 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)									
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)			
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP	SSP
Cabbage	46.00	23.00	30.00	100.00	144.00	50.00	144.00	50.00	12.00	

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 30 and 45 days after planting.
- **Option 2:** Apply suphala and MoP as a basal dressing. Split the urea into 2 parts and top-dress at 30 and 45 days after planting.
- Use FYM 5 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Tomato	22.50	5.75	18.75	49.00	36.00	31.00	36.00	35.00	22.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 20 and 45 days after planting.
- **Option 2:** Apply suphala, and MoP, as a basal dressing. Split the urea into 2 parts and top-dress at 20 and 45 days after planting.
- Use FYM 5 tonnes per acre at land preparation.

Crop	Time	Fertilizer Recommendations (kg/ac)									
		Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)			
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP	SSP
Asparagus											
1st year	Basal	40.00	38.00	30.00	87.00	238.00	50.00	188.00	22.00		50.00
2nd year	Side	60.00	46.00	80.00	130.00	288.00	133.00	289.00	30.00	56.00	
Apply 2-3 tonnes of FYM /compost at transplanting. From the 2nd year, side dress fertilizer											
Beans	Basal	17.50	44.00	69.00	38.00	275.00	115.00	110.00		85.00	166.00

Apply 2-3 tonnes of FYM. Grows on wide range of soils, pH 5.5-6.8. Legume needs little N.											
Brinjal	Basal TD	20.00 20.00	28.00	13.20	43.00 43.00	175.00	22.00	83.00	15.00 43.00		93.00
Apply 4-5 tonnes of FYM.TD 30 DAT											
Carrot	Basal	10.00	4.40	27.60	22.00	28.00	46.00	28.00	12.00	39.00	
Apply 4-5 tonnes of FYM. Needs K for proper development of roots.											
Chinese Cabbage	Basal TD1 TD2	20.00 20.00 10.00	33.00	18.40	43.00 43.00 22.00	206.00	31.00	115.00	3.00 43.00 22.00		91.00
Apply 5-6 tonnes of FYM. Requires well-drained soils, pH 6-6.8. 1st top dressing 30 DAT 2nd top dressing 60 DAT											
Cucumber	Basal TD	20.00 18.00	44.00	34.50	43.00 39.00	275.00	57.00	125.00	39.00	24.00	150.00
Apply 8-10 tonnes of FYM. Requires good moisture & FYM/OM. Loamy soils best, pH 5.5-6.8. Top dress 4-6 weeks after planting.											
Lettuce	Basal	10.00	17.60	9.20	22.00	110.00	15.00	58.00	2.00		53.00
Apply 2-3 tonnes of FYM. Needs continuous moisture so irrigation /water source essential											
Onion	Basal TD	25.00 25.00	33.00	34.50	54.00 54.00	206.00	57.00	156.00	54.00	16.00	50.00
Apply 5 tonnes of FYM. Grows on any soil with good FYM/OM. Bulbs may be poor on heavy wet soils. Optimum pH 6.0-6.8. Top-dress 30 DAP.											
Pea	Basal	25.00	32.20	40.25	54.00	201.00	67.00	156.00		25.00	45.00
Apply 2-3 tonnes of FYM. Grows on all soils, except if waterlogged or compacted. Legume so needs little N.											
Radish	Basal	25.00	17.60	34.50	54.00	110.00	57.00	110.00	16.00	28.00	
Apply 2-3 tonnes of FYM. Grows best in light OM-rich soil pH 6.6-6.8.											
Saag and Spinach	Basal	37.50	33.00	34.50	82.00	206.00	57.00	206.00	10.00	2.00	
Apply 8-10 tonnes of FYM. Grow well in all soils; prefer well drained and adequate FYM/OM. pH 6-6.8.											
NB: TD = Top dressing; DAP = Days after planting; DAT = Days after transplanting FYM = farmyard manure; OM = Organic matter e.g. FYM, compost, leaf litter											

Fertilizer recommendation for fruit plants and plantation crops

Fruit tree	Plant Nutrient	Non-Bearing trees (g/tree/yr)		Bearing trees (g/tree/yr)	
		Nutrient	Fertilizer	Nutrient	Fertilizer
Citrus	N	100	217g Urea	250	544g Urea
	P_2O_5	50	313g SSP	100	625g SSP
	K_2O	150	249g MoP	350	581g MoP
		Using suphala: Apply suphala: 313g, urea 109g and MoP: 166g		Using suphala: Apply suphala: 625g, urea: 326g and MoP: 415g	
	Fertilizer application: After harvest & prior to spring flush. FYM to be applied based upon availability				

Fruit tree	Plant Nutrient	Age 1-3 years (g/tree/yr)		Age 4-6 years (g/tree/yr)		Age 7 and above (g/tree/yr)	
		Nutrient	**Fertilizer**	**Nutrient**	**Fertilizer**	**Nutrient**	**Fertilizer**
Mango	N	92	200g Urea	138	300g Urea	253	550g Urea
	P_2O_5	56	350g SSP	80	500g SSP	112	700g SSP
	K_2O	210	349g MoP	330	548g MoP	420	697g MoP
		Using suphala: Apply suphala: 350g, urea 78g and MoP: 256g		Using suphala: Apply suphala: 500g, urea: 126g and MoP: 415g		Using suphala: Apply suphala: 700g, urea: 307g and MoP: 511g	
	Fertilizer application: After harvest & prior to spring flush. FYM to be applied based upon availability						

14.11 Samdrupjongkhar Dzongkhag

Soil nutrient status

Rating class	pH	OM%	Total N%	AvP (mg/kg)	AvK (mg/kg)	Texture
	5.46	3.52	0.21	15.00	53.45	Clay Loam
	Very Acidic	Medium	Medium	Medium	Low	

The soil pH is very acidic (refer to lime recommendation section 5). The organic matter, total nitrogen, and available phosphorus levels are within the medium range, whereas the available potassium is within the low range. The soil texture is clay loam.

Fertilizer recommendation for cereals

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizers (Option 1)			Fertilizers (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Rice	2.00	45.00	6.00	37.50	98.00	38.00	62.00	38.00	85.00	52.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the top-dressed urea into 2 equal parts and apply half at 20-35 days after transplanting (DAT) at tillering stage, and the remaining half at 40-50 DAT (panicle initiation stage).
- **Option 2:** Apply the entire dose of suphala, MoP and $^1/_3$ urea as basal dressing, then top-dress the other $^1/_3$ at 20-35 DAT (tillering stage) and the remaining $^1/_3$ at 40-50 DAT (panicle initiation stage).
- Do not apply urea top-dressing when heavy rainfall is expected.
- Do not apply urea on to standing water, under windy conditions before canopy closure, or at midday when the water temperature is highest.
- When top-dressing, close the terrace water inlets and outlets for at least three days.
- Use at least 2-3 tonnes/acre of FYM at land preparation and plough or cultivate it into the soil before sowing, planting or transplanting.

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizer (Option 1)				Fertilizers (Option 2)	
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Wheat	1.20	12.60	12.00	31.20	27.00	75.00	52.00	75.00		32.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Top-dressed the other half immediately before the first irrigation, at crown root initiation stage (20-40 days after sowing depending on altitude).
- **Option 2:** Apply the entire dose of suphala and MoP as basal dressing.
- To avoid unproductive tillering and secondary shoots, restrict nutrient supply (especially N) to early growth stages (i.e. start of tillering).
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrients			Fertilizer (Option 1)				Fertilizers (Option 2)	
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	MoP	SSP
Buckwheat	6.00	10.00	8.00	13.00	63.00	13.00	38.00	3.00	25.00

- **Option 1:** Apply the entire dose of SSP, MoP and urea as a basal dressing.
- **Option 2:** Apply the entire dose of suphala, MoP and SSP as basal dressing.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrients			Fertilizer (Option 1)				Fertilizers (Option 2)	
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Millet	24.00	11.00	12.00	52.00	69.00	20.00	69.00	28.00	2.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing and, apply the other half urea 30-40 days after sowing
- **Option 2:** Apply the entire dose of suphala and MoP and, apply urea as top-dressing 30-40 days after sowing.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Maize	1.80	45.00	18.00	66.24	98.00	113.00	110.00	113.00	59.00	80.00

- **Option 1:** Apply the entire dose of SSP, MoP and $^1/_3$ urea as a basal dressing. Top-dressed $^1/_3$ urea at 35-40 days after planting (knee high stage) and the remaining $^1/_3$ at 60-70 days (tasseling stage).
- **Option 2:** Apply the entire dose of suphala, MoP as basal dressing. Top-dress half urea at 35-40 days after planting (knee high stage) and the remaining half at 60-70 days (tasseling stage).
- Use FYM 2-3 tonnes per acre at land preparation.

Fertilizer recommendation for potato

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizers (Option 1)			Fertilizers (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Potato	3.45	21.53	6.89	34.45	47.00	43.00	57.00	43.00	32.00	46.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Top-dressed half urea at earthing up when the leaves are about 10-15 cm long, or at tuber initiation.
- **Option 2:** Apply the entire dose of suphala and MoP and $^1/_3$ urea as basal dressing, then top-dress the remaining at earthing up when the leaves are about 10-15 cm long, or at tuber initiation.
- Potato uses large amounts of N, frequently more than the total applied as fertilizer. Therefore, it is advised to be applied in at least two to three spilt applications. However, excess N at or before tuberization can delay tuber growth and reduce yields.
- Potato requires high levels of available soil K. Potassium is relatively immobile in the soil. For best results, K fertilizers should be applied pre-plant and mixed into the seedbed.
- Phosphorus (P) is immobile in soil and therefore does not move from where it is placed. P fertilizers should either be mixed into the seedbed before planting or banded at planting.
- Place fertilizers close to but not in contact with seed tubers for more efficient fertilizer use.
- Use FYM 5 tonnes per acre at land preparation.

Fertilizer recommendation for vegetables

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Chilli (rainfed)	24.00	18.00	27.00	52.00	113.00	45.00	113.00	13.00	15.00
Chilli (irrigated)	28.00	24.00	36.00	61.00	150.00	60.00	150.00	9.00	20.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 top-dressings at 30 and 60 days after planting.
- **Option 2:** Apply entire suphala as a basal dressing.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Cauliflower	40.00	24.00	48.00	87.00	150.00	80.00	150.00	35.00	40.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 30 and 60 days after planting.
- **Option 2:** Apply suphala and MoP as a basal dressing. Split the urea into 2 parts and top-dress at 30 and 60 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)									
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)			
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP	SSP
Cabbage	40.00	20.00	36.00	87.00	125.00	60.00	125.00	43.00	27.00	

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 30 and 45 days after planting.
- **Option 2:** Apply suphala, MoP, SSP as a basal dressing. Split the urea into 2 parts and top-dress at 30 and 45 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Tomato	18.75	5.00	22.50	41.00	31.00	37.00	31.00	30.00	29.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 20 and 45 days after planting.
- **Option 2:** Apply suphala, and MoP, as a basal dressing. Split the urea into 2 parts and top-dress at 20 and 45 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Time	Fertilizer Recommendations (kg/ac)									
		Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)			
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP	SSP
Asparagus 1st year 2nd year	 Basal Side	 20.00 60.00	 30.00 46.00	 30.00 80.00	 43.00 130.00	 188.00 288.00	 50.00 133.00	 125.00 288.00	 30.00	 17.00 56.00	 63.00
Apply 2-3 tonnes of FYM /compost at transplanting. From the 2nd year, side dress fertilizer											
Beans	Basal	14.00	40.00	69.00	30.00	250.00	115.00	88.00		91.00	163.00
Apply 2-3 tonnes of FYM. Grows on wide range of soils, pH 5.5-6.8. Legume needs little N.											
Brinjal	Basal TD	12.00 20.00	28.00	13.80	26.00 43.00	175.00	23.00	75.00	 43.00	3.00	100.00
Apply 4-5 tonnes of FYM.TD 30 DAT											
Carrot	Basal	8.00	4.00	27.60	17.00	25.00	46.00	25.00	9.00	39.00	
Apply 4-5 tonnes of FYM. Needs K for proper development of roots.											
Chinese Cabbage	Basal TD1 TD2	20.00 10.00 10.00	30.00	18.40	43.00 22.00 22.00	188.00	31.00	115.00	3.00 22.00 22.00		73.00
Apply 5-6 tonnes of FYM. Requires well-drained soils, pH 6-6.8. 1st top dressing 30 DAT 2nd top dressing 60 DAT											
Cucumber	Basal TD	20.00 10.00	40.00	34.50	43.00 22.00	250.00	57.00	125.00	 22.00	24.00	125.00
Apply 8-10 tonnes of FYM. Requires good moisture & FYM/OM. Loamy soils best, pH 5.5-6.8. Top dress 4-6 weeks after planting.											
Lettuce	Basal	8.00	16.00	9.20	17.00	100.00	15.00	50.00		2.00	50.00
Apply 2-3 tonnes of FYM. Needs continuous moisture so irrigation /water source essential											
Onion	Basal TD	20.00 20.00	30.00	34.50	43.00 43.00	188.00	57.00	125.00	 43.00	24.00	63.00
Apply 5 tonnes of FYM. Grows on any soil with good FYM/OM. Bulbs may be poor on heavy wet soils. Optimum pH 6.0-6.8. Top-dress 30 DAP.											
Pea	Basal	20.00	32.00	40.25	43.00	200.00	67.00	125.00		34.00	75.00
Apply 2-3 tonnes of FYM. Grows on all soils, except if waterlogged or compacted. Legume so needs little N.											
Radish	Basal	20.00	16.00	34.50	43.00	100.00	57.00	100.00	9.00	31.00	
Apply 2-3 tonnes of FYM. Grows best in light OM-rich soil pH 6.6-6.8.											
Saag and Spinach	Basal	30.00	30.00	34.50	65.00	188.00	57.00	188.00		7.00	
Apply 8-10 tonnes of FYM. Grow well in all soils; prefer well drained and adequate FYM/OM. pH 6-6.8.											
NB: TD = Top dressing; DAP = Days after planting; DAT = Days after transplanting FYM = farmyard manure; OM = Organic matter e.g. FYM, compost, leaf litter											

Fertilizer recommendation for fruit plants and plantation crops

Fruit tree	Plant Nutrient	Non-Bearing trees (g/tree/yr)		Bearing trees (g/tree/yr)	
		Nutrient	Fertilizer	Nutrient	Fertilizer
Citrus	N	75	163g Urea	200	435g Urea
	P_2O_5	35	219g SSP	75	469g SSP
	K_2O	150	249g MoP	350	581g MoP
		Using suphala: Apply suphala: 219g, urea: 87g and MoP: 191g		Using suphala: Apply suphala: 469g, urea: 272g and MoP: 457g	
	Fertilizer application: After harvest & prior to spring flush. FYM to be applied based upon availability				

Plantation crop	Plant Nutrient	Year 1 (g/palm/year)		Year 2 (g/palm/year)		Year 3 (g/palm/year)	
		Nutrient	Fertilizer (g)	Nutrient	Fertilizer (g)	Nutrient	Fertilizer (g)
Areca-nut	N	57	124g Urea	62	135g Urea	82	178g Urea
	P_2O_5	15	94g SSP	28	175g SSP	40	250g SSP
	K_2O	90	149g MoP	120	199g MoP	150	249g MoP
		Using suphala: Apply suphala: 94g, urea: 91g and MoP: 125g		Using suphala: Apply suphala: 175g, urea: 74g and MoP: 153g		Using suphala: Apply suphala: 250g, urea 91g and MoP: 183g	

- For areca-nut, apply farmyard manure in planting pit and yearly 1-3 baskets/palm/year, according to tree size. FYM and compost may be applied in single dose in September – October.
- The fertilizer may be applied in two split doses: one third of the fertilizer may be applied in May-June and two third along with the organics during September –October.
- The first dose of fertilizers may be applied in basins of about 1m radius, made around the palm to a depth of 15-20cm.
- The second dose of fertilizers can be applied to the base of each palm all around and mixed with the soil by a light forking.

14.12 Samtse Dzongkhag

Soil nutrient status

Rating class	pH	OM%	Total N%	AvP (mg/kg)	AvK (mg/kg)	Texture
	5.14	3.51	0.15	9.88	34.57	Clay Loam
	Very Acidic	Medium	Low	Low	Low	

The soil pH is very acidic (refer to lime recommendation section 5). The organic matter is in the medium range. However, all three major nutrients, total nitrogen, available phosphorus, and potassium, are within the low range. The soil texture is clay loam.

Fertilizer recommendation for cereals

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizers (Option 1)			Fertilizers (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Rice	2.00	45.00	7.50	37.50	98.00	47.00	62.00	47.00	82.00	50.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the top-dressed urea into 2 equal parts and apply half at 20-35 days after transplanting (DAT) at tillering stage, and the remaining half at 40-50 DAT (panicle initiation stage).
- **Option 2:** Apply the entire dose of suphala, MoP and $^1/_3$ urea as basal dressing, then top-dress the other $^1/_3$ at 20-35 DAT (tillering stage) and the remaining $^1/_3$ at 40-50 DAT (panicle initiation stage).
- Do not apply urea top-dressing when heavy rainfall is expected.
- Do not apply urea on to standing water, under windy conditions before canopy closure, or at midday when the water temperature is highest.
- When top-dressing, close the terrace water inlets and outlets for at least three days.
- Use at least 2-3 tonnes/acre of FYM at land preparation and plough or cultivate it into the soil before sowing, planting or transplanting.

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizer (Option 1)				Fertilizers (Option 2)	
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Wheat	1.20	30.36	13.80	31.20	66.00	86.00	52.00	87.00	36.00	29.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Top-dressed the other half immediately before the first irrigation, at crown root initiation stage (20-40 days after sowing depending on altitude).
- **Option 2:** Apply the entire dose of suphala and MoP as basal dressing, then top-dress the urea immediately before the first irrigation, at crown root initiation stage (20-40 days after sowing depending on altitude).
- To avoid unproductive tillering and secondary shoots, restrict nutrient supply (especially N) to early growth stages (i.e. start of tillering).
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrients			Fertilizer (Option 1)				Fertilizers (Option 2)	
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	MoP	SSP
Buckwheat	6.00	14.00	8.00	13.00	88.00	13.00	38.00	3.00	50.00

- **Option 1:** Apply the entire dose of SSP, MoP and urea as a basal dressing.
- **Option 2:** Apply the entire dose of suphala, MoP and SSP as basal dressing.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrients			Fertilizer (Option 1)				Fertilizers (Option 2)	
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Millet	24.00	12.00	12.00	52.00	75.00	20.00	75.00	26.00	

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing and, apply the other half urea 30-40 days after sowing
- **Option 2:** Apply the entire dose of suphala and MoP and, apply urea as top-dressing 30-40 days after sowing.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Maize	1.80	49.50	22.50	72.00	108.00	141.00	120.00	141.00	59.00	82.00

- **Option 1:** Apply the entire dose of SSP, MOP and $^1/_3$ urea as a basal dressing. Top-dressed $^1/_3$ urea at 35-40 days after planting (knee high stage) and the remaining $^1/_3$ at 60-70 days (tasseling stage).
- **Option 2:** Apply the entire dose of suphala, MoP as basal dressing. Top-dress half urea at 35-40 days after planting (knee high stage) and the remaining half at 60-70 days (tasseling stage).
- Use FYM 2-3 tonnes per acre at land preparation.

Fertilizer recommendation for potato

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizers (Option 1)			Fertilizers (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Potato	3.41	21.29	8.52	34.07	46.00	53.00	57.00	53.00	28.00	42.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Top-dressed half urea at earthing up when the leaves are about 10-15 cm long, or at tuber initiation.
- **Option 2:** Apply the entire dose of suphala and MoP and $^1/_3$ urea as basal dressing, then top-dress the remaining at earthing up when the leaves are about 10-15 cm long, or at tuber initiation.
- Potato uses large amounts of N, frequently more than the total applied as fertilizer. Therefore, it is advised to be applied in at least two to three spilt applications. However, excess N at or before tuberization can delay tuber growth and reduce yields.

- Potato requires high levels of available soil K. Potassium is relatively immobile in the soil. For best results, K fertilizers should be applied pre-plant and mixed into the seedbed.
- Phosphorus (P) is immobile in soil and therefore does not move from where it is placed. P fertilizers should either be mixed into the seedbed before planting or banded at planting.
- Place fertilizers close to but not in contact with seed tubers for more efficient fertilizer use.
- Use FYM 5 tonnes per acre at land preparation.

Fertilizer recommendation for mustard

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrients			Fertilizers (Option 1)			Fertilizers (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Mustard	20.00	12.50	12.50	43.00	78.00	21.00	78.00	16.00	

- **Option 1:** Apply the entire dose of SSP, MoP and urea as a basal dressing.
- **Option 2:** Apply the entire dose of suphala and urea as basal dressing.

Fertilizer recommendation for vegetables

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Chilli (rainfed)	30.00	22.50	27.00	65.00	141.00	45.00	141.00	16.00	7.00
Chilli (irrigated)	35.00	30.00	36.00	76.00	188.00	60.00	188.00	11.00	10.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 top-dressings at 30 and 60 days after planting.
- **Option 2:** Apply entire suphala as a basal dressing.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Cauliflower	46.00	30.00	48.00	100.00	188.00	80.00	188.00	35.00	30.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 30 and 60 days after planting.
- **Option 2:** Apply suphala and MoP as a basal dressing. Split the urea into 2 parts and top-dress at 30 and 60 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)									
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)			
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP	SSP
Cabbage	46.00	25.00	36.00	98.00	156.00	60.00	156.00	43.00	18.00	

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 30 and 45 days after planting.
- **Option 2:** Apply suphala, MoP, SSP as a basal dressing. Split the urea into 2 parts and top-dress at 30 and 45 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Tomato	22.50	6.25	22.50	49.00	39.00	37.00	39.00	35.00	27.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 20 and 45 days after planting.
- **Option 2:** Apply suphala, and MoP, as a basal dressing. Split the urea into 2 parts and top-dress at 20 and 45 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Time	Fertilizer Recommendations (kg/ac)									
		Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)			
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP	SSP
Asparagus 1st year 2nd year	 Basal Side	 30.00 70.00	 30.00 46.00	 35.00 80.00	 65.00 152.00	 188.00 288.00	 58.00 133.00	 188.00 288.00	 52.00	 8.00 57.00	
Apply 2-3 tonnes of FYM /compost at transplanting. From the 2nd year, side dress fertilizer											
Beans	Basal	17.50	40.00	72.00	38.00	250.00	120.00	109.00		90.00	141.00
Apply 2-3 tonnes of FYM. Grows on wide range of soils, pH 5.5-6.8. Legume needs little N.											
Brinjal	Basal TD	20.00 20.00	28.00	14.40	43.00 43.00	175.00	24.00	90.00	12.00 43.00		85.00
Apply 4-5 tonnes of FYM.TD 30 DAT											
Carrot	Basal	10.00	6.00	28.80	22.00	38.00	48.00	38.00	9.00	38.00	
Apply 4-5 tonnes of FYM. Needs K for proper development of roots.											
Chinese Cabbage	Basal TD1 TD2	30.00 10.00 10.00	30.00	19.20	65.00 22.00 22.00	188.00	32.00	120.00	23.00 22.00 22.00		68.00
Apply 5-6 tonnes of FYM. Requires well-drained soils, pH 6-6.8. 1st top dressing 30 DAT 2nd top dressing 60 DAT											
Cucumber	Basal TD	20.00 18.00	40.00	36.00	43.00 39.00	250.00	60.00	125.00	 39.00	27.00	125.00
Apply 8-10 tonnes of FYM. Requires good moisture & FYM/OM. Loamy soils best, pH 5.5-6.8. Top dress 4-6 weeks after planting.											
Lettuce	Basal	10.00	16.00	9.60	22.00	100.00	16.00	60.00	1.00		40.00
Apply 2-3 tonnes of FYM. Needs continuous moisture so irrigation /water source essential											
Onion	Basal TD	20.00 30.00	30.00	36.00	43.00 65.00	188.00	60.00	125.00	 65.00	27.00	63.00
Apply 5 tonnes of FYM. Grows on any soil with good FYM/OM. Bulbs may be poor on heavy wet soils. Optimum pH 6.0-6.8. Top-dress 30 DAP.											
Pea	Basal	25.00	32.00	42.00	54.00	200.00	70.00	157.00		28.00	44.00
Apply 2-3 tonnes of FYM. Grows on all soils, except if waterlogged or compacted. Legume so needs little N.											
Radish	Basal	25.00	16.00	36.00	54.00	100.00	60.00	100.00	20.00	33.00	
Apply 2-3 tonnes of FYM. Grows best in light OM-rich soil pH 6.6-6.8.											
Saag and Spinach	Basal	37.50	30.00	36.00	82.00	188.00	60.00	188.00	16.00	10.00	-
Apply 8-10 tonnes of FYM. Grow well in all soils; prefer well drained and adequate FYM/OM. pH 6-6.8.											
NB: TD = Top dressing; DAP = Days after planting; DAT = Days after transplanting FYM = farmyard manure; OM = Organic matter e.g. FYM, compost, leaf litter											

Fertilizer recommendation for fruit plants and plantation crops

Fruit tree	Plant Nutrient	Non-Bearing trees (g/tree/yr)		Bearing trees (g/tree/yr)	
		Nutrient	Fertilizer	Nutrient	Fertilizer
Citrus	N	100	217g Urea	250	544g Urea
	P_2O_5	50	313g SSP	100	625g SSP
	K_2O	150	249g MoP	350	581g MoP
		Using suphala: Apply suphala: 313g, urea: 109g and MoP: 166g		Using suphala: Apply suphala: 625g, urea: 326g and MoP: 415g	
	Fertilizer application: After harvest & prior to spring flush. FYM to be applied based upon availability				

Plantation crop	Plant Nutrient	Year 1 (g/palm/year)		Year 2 (g/palm/year)		Year 3 (g/palm/year)	
		Nutrient	Fertilizer (g)	Nutrient	Fertilizer (g)	Nutrient	Fertilizer (g)
Areca-nut	N	69	150g Urea	72	157g Urea	92	200g Urea
	P_2O_5	16	100g SSP	32	200g SSP	48	300g SSP
	K_2O	90	149g MoP	120	199g MoP	150	249g MoP
		Using suphala: Apply suphala: 100g, urea: 115g and MoP: 123g		Using suphala: Apply suphala: 200g, urea: 87g and MoP: 146g		Using suphala: Apply suphala: 300g, urea: 96g and MoP: 169g	

- ❖ Apply farmyard manure in planting pit and yearly 1-3 baskets/palm/year, according to tree size. FYM and compost may be applied in single dose in September – October.
- ❖ The fertilizer may be applied in two split doses: one third of the fertilizer may be applied in May-June and two third along with the organics during September –October.
- ❖ The first dose of fertilizers may be applied in basins of about 1m radius, made around the palm to a depth of 15-20cm.
- ❖ The second dose of fertilizers can be applied to the base of each palm all around and mixed with the soil by a light forking.

14.13 Sarpang Dzongkhag

Soil nutrient status

	pH	OM%	Total N%	AvP (mg/kg)	AvK (mg/kg)	Texture
Rating class	5.12	3.26	0.17	32.75	35.98	Loam
	Very Acidic	Medium	Low	High	Low	

The soil pH is very acidic (refer to lime recommendation section 5). The organic matter is within the medium range. The two major nutrients, total nitrogen, and available potassium levels are low in the soil. The phosphorus levels are high and the soil texture is loam.

Fertilizer recommendation for cereals

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizers (Option 1)			Fertilizers (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Rice (Local)		32.00	5.75	12.00	70.00	36.00	20.00	36.00	57.00	10.00
Rice (Improved)	2.00	44.00	5.75	37.50	96.00	36.00	62.00	36.00	83.00	53.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the top-dressed urea into 2 equal parts and apply half at 20-35 days after transplanting (DAT) at tillering stage, and the remaining half at 40-50 DAT (panicle initiation stage).
- **Option 2:** Apply the entire dose of suphala, MoP and $^1/_3$ urea as basal dressing, then top-dress the other $^1/_3$ at 20-35 DAT (tillering stage) and the remaining $^1/_3$ at 40-50 DAT (panicle initiation stage).
- Do not apply urea top-dressing when heavy rainfall is expected.
- Do not apply urea on to standing water, under windy conditions before canopy closure, or at midday when the water temperature is highest.
- When top-dressing, close the terrace water inlets and outlets for at least three days.
- Use at least 2-3 tonnes/acre of FYM at land preparation and plough or cultivate it into the soil before sowing, planting or transplanting.

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizer (Option 1)				Fertilizers (Option 2)	
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Wheat	1.20	30.36	9.00	31.20	66.00	56.00	52.00	56.00	46.00	37.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Top-dressed the other half immediately before the first irrigation, at crown root initiation stage (20-40 days after sowing depending on altitude).
- **Option 2:** Apply the entire dose of suphala and MoP as basal dressing, then top-dress the urea immediately before the first irrigation, at crown root initiation stage (20-40 days after sowing depending on altitude).
- To avoid unproductive tillering and secondary shoots, restrict nutrient supply (especially N) to early growth stages (i.e. start of tillering).
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrients			Fertilizer (Option 1)				Fertilizers (Option 2)	
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	MoP	SSP
Buckwheat	6.00	6.00	8.00	13.00	38.00	13.00	38.00	3.00	

- **Option 1:** Apply the entire dose of SSP, MoP and urea as a basal dressing.
- **Option 2:** Apply the entire dose of suphala and MoP as basal dressing.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrients			Fertilizer (Option 1)				Fertilizers (Option 2)	
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Millet	24.00	10.00	12.00	52.00	63.00	20.00	63.00	30.00	3.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing and, apply the other half urea 30-40 days after sowing
- **Option 2:** Apply the entire dose of suphala and MoP and, apply urea as top-dressing 30-40 days after sowing.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Maize	1.80	53.00	13.50	72.00	115.00	84.00	120.00	84.00	86.00	97.00

- **Option 1:** Apply the entire dose of SSP, MoP and $^1/_3$ urea as a basal dressing. Top-dressed $^1/_3$ urea at 35-40 days after planting (knee high stage) and the remaining $^1/_3$ at 60-70 days (tasseling stage).
- **Option 2:** Apply the entire dose of suphala, MoP as basal dressing. Top-dress half urea at 35-40 days after planting (knee high stage) and the remaining half at 60-70 days (tasseling stage).
- Use FYM 2-3 tonnes per acre at land preparation.

Fertilizer recommendation for potato

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizers (Option 1)			Fertilizers (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Potato	3.41	24.81	6.47	33.61	54.00	40.00	56.00	40.00	40.00	45.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Top-dressed half urea at earthing up when the leaves are about 10-15 cm long, or at tuber initiation.
- **Option 2:** Apply the entire dose of suphala and MoP and $^1/_3$ urea as basal dressing, then top-dress the remaining at earthing up when the leaves are about 10-15 cm long, or at tuber initiation.
- Potato uses large amounts of N, frequently more than the total applied as fertilizer. Therefore, it is advised to be applied in at least two to three spilt applications. However, excess N at or before tuberization can delay tuber growth and reduce yields.
- Potato requires high levels of available soil K. Potassium is relatively immobile in the soil. For best results, K fertilizers should be applied pre-plant and mixed into the seedbed.

- Phosphorus (P) is immobile in soil and therefore does not move from where it is placed. P fertilizers should either be mixed into the seedbed before planting or banded at planting.
- Place fertilizers close to but not in contact with seed tubers for more efficient fertilizer use.
- Use FYM 5 tonnes per acre at land preparation.

Fertilizer recommendation for mustard

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrients			Fertilizers (Option 1)			Fertilizers (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Mustard	28.00	9.75	12.50	61.00	61.00	21.00	61.00	40.00	5.00

- **Option 1:** Apply the entire dose of SSP, MoP and urea as a basal dressing.
- **Option 2:** Apply the entire dose of suphala and urea as basal dressing.

Fertilizer recommendation for vegetables

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Chilli (rainfed)	32.00	13.50	27.00	70.00	84.00	45.00	84.00	40.00	22.00
Chilli (irrigated)	36.00	18.00	36.00	78.00	113.00	60.00	113.00	39.00	30.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 top-dressings at 30 and 60 days after planting.
- **Option 2:** Apply entire suphala as a basal dressing.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Cauliflower	48.00	18.00	48.00	104.00	113.00	80.00	113.00	65.00	50.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 30 and 60 days after planting.
- **Option 2:** Apply suphala and MoP as a basal dressing. Split the urea into 2 parts and top-dress at 30 and 60 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)									
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)			
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP	SSP
Cabbage	48.00	15.00	36.00	104.00	94.00	60.00	94.00	72.00	35.00	

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 30 and 45 days after planting.
- **Option 2:** Apply suphala, MoP, SSP as a basal dressing. Split the urea into 2 parts and top-dress at 30 and 45 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Tomato	23.00	3.75	22.50	50.00	23.00	37.00	23.00	42.00	31.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 20 and 45 days after planting.
- **Option 2:** Apply suphala, and MoP, as a basal dressing. Split the urea into 2 parts and top-dress at 20 and 45 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Time	Fertilizer Recommendations (kg/ac)									
		Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)			
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP	SSP
Asparagus 1st year 2nd year	 Basal Side	 18.00 70.00	 20.00 37.00	 35.00 80.00	 39.00 152.00	 125.00 231.00	 58.00 133.00	 113.00 231.00	 72.00	 28.00 71.00	 13.00
Apply 2-3 tonnes of FYM /compost at transplanting. From the 2nd year, side dress fertilizer											
Beans	Basal	22.00	30.00	72.00	48.00	188.00	120.00	138.00		83.00	50.00
Apply 2-3 tonnes of FYM. Grows on wide range of soils, pH 5.5-6.8. Legume needs little N.											
Brinjal	Basal TD	20.00 20.00	21.00	14.40	43.00 43.00	131.00	24.00	90.00	12.00 43.00		41.00
Apply 4-5 tonnes of FYM.TD 30 DAT											
Carrot	Basal	16.00	4.00	28.80	35.00	25.00	48.00	25.00	26.00	41.00	
Apply 4-5 tonnes of FYM. Needs K for proper development of roots.											
Chinese Cabbage	Basal TD1 TD2	30.00 10.00 8.00	22.50	19.20	65.00 22.00 17.00	141.00	32.00	120.00	23.00 22.00 17.00		21.00
Apply 5-6 tonnes of FYM. Requires well-drained soils, pH 6-6.8. 1st top dressing 30 DAT 2nd top dressing 60 DAT											
Cucumber	Basal TD	20.00 18.00	30.00	36.00	43.00 39.00	188.00	60.00	125.00	 39.00	27.00	63.00
Apply 8-10 tonnes of FYM. Requires good moisture & FYM/OM. Loamy soils best, pH 5.5-6.8. Top dress 4-6 weeks after planting.											
Lettuce	Basal	16.00	12.00	9.60	35.00	75.00	16.00	60.00	14.00		15.00
Apply 2-3 tonnes of FYM. Needs continuous moisture so irrigation /water source essential											
Onion	Basal TD	20.00 20,00	23.00	36.00	43.00 43.00	144.00	60.00	125.00	 43.00	27.00	19.00
Apply 5 tonnes of FYM. Grows on any soil with good FYM/OM. Bulbs may be poor on heavy wet soils. Optimum pH 6.0-6.8. Top-dress 30 DAP.											
Pea	Basal	28.00	24.00	42.00	61.00	150.00	70.00	150.00	9.00	30.00	
Apply 2-3 tonnes of FYM. Grows on all soils, except if waterlogged or compacted. Legume so needs little N.											
Radish	Basal	28.00	12.00	36.00	61.00	75.00	60.00	75.00	35.00	40.00	
Apply 2-3 tonnes of FYM. Grows best in light OM-rich soil pH 6.6-6.8.											
Saag and Spinach	Basal	38.00	22.50	36.00	83.00	141.00	60.00	141.00	34.00		22.00
Apply 8-10 tonnes of FYM. Grow well in all soils; prefer well drained and adequate FYM/OM. pH 6-6.8.											
NB: TD = Top dressing; DAP = Days after planting; DAT = Days after transplanting FYM = farmyard manure; OM = Organic matter e.g. FYM, compost, leaf litter											

Fertilizer recommendation for fruit plants and plantation crops

Fruit tree	Plant Nutrient	Non-Bearing trees (g/tree/yr)		Bearing trees (g/tree/yr)	
		Nutrient	Fertilizer	Nutrient	Fertilizer
Citrus	N	100	217g Urea	250	544g Urea
	P_2O_5	25	156g SSP	50	313g SSP
	K_2O	150	249g MoP	350	581g MoP
		Using suphala: Apply suphala: 156g, urea: 163g and MoP: 208g		Using suphala: Apply suphala: 313g, urea: 435g and MoP: 498g	
	Fertilizer application: After harvest & prior to spring flush. FYM to be applied based upon availability				

Plantation crop	Plant Nutrient	Year 1 (g/palm/year)		Year 2 (g/palm/year)		Year 3 (g/palm/year)	
		Nutrient	Fertilizer (g)	Nutrient	Fertilizer (g)	Nutrient	Fertilizer (g)
Areca-nut	N	69	150g Urea	72	157g Urea	92	200g Urea
	P_2O_5	14	86g SSP	24	150g SSP	32	200g SSP
	K_2O	90	149g MoP	120	199g MoP	150	229g MoP
		Using suphala: Apply suphala: 88g, urea: 120g and MoP: 126g		Using suphala: Apply suphala: 150g, urea: 104g and MoP: 159g		Using suphala: Apply suphala: 200g, urea: 130g and MoP: 196g	

- ❖ Apply farmyard manure in planting pit and yearly 1-3 baskets/palm/year, according to tree size. FYM and compost may be applied in single dose in September – October.
- ❖ The fertilizer may be applied in two split doses: one third of the fertilizer may be applied in May-June and two third along with the organics during September –October.
- ❖ The first dose of fertilizers may be applied in basins of about 1m radius, made around the palm to a depth of 15-20cm.
- ❖ The second dose of fertilizers can be applied to the base of each palm all around and mixed with the soil by a light forking.

14.14 Thimphu Dzongkhag

Soil nutrient status

	pH	OM%	Total N%	AvP (mg/kg)	AvK (mg/kg)	Texture
Rating class	6.04	3.30	0.13	11.04	136.19	Loam
	Slightly Acidic	Medium	Low	Low	Medium	

The soil pH is slightly acidic, optimum for the growth of most crops. The organic matter and available potassium levels are within the medium range. However, total nitrogen and phosphorus levels are low in the soil. The soil texture is loam.

Fertilizer recommendation for cereals

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizers (Option 1)			Fertilizers (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Rice (Local)		30.00	9.38	12.00	65.00	59.00	20.00	59.00	45.00	4.00
Rice (Improved)	2.50	56.25	9.38	37.50	122.00	59.00	62.00	59.00	102.00	47.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the top-dressed urea into 2 equal parts and apply half at 20-35 days after transplanting (DAT) at tillering stage, and the remaining half at 40-50 DAT (panicle initiation stage).
- **Option 2:** Apply the entire dose of suphala, MoP and $^1/_3$ urea as basal dressing, then top-dress the other $^1/_3$ at 20-35 DAT (tillering stage) and the remaining $^1/_3$ at 40-50 DAT (panicle initiation stage).
- Do not apply urea top-dressing when heavy rainfall is expected.
- Do not apply urea on to standing water, under windy conditions before canopy closure, or at midday when the water temperature is highest.
- When top-dressing, close the terrace water inlets and outlets for at least three days.
- Use at least 2-3 tonnes/acre of FYM at land preparation and plough or cultivate it into the soil before sowing, planting or transplanting.

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizer (Option 1)				Fertilizers (Option 2)	
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Wheat	1.20	30.36	15.00	24.00	66.00	94.00	40.00	94.00	33.00	15.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Top-dressed the other half immediately before the first irrigation, at crown root initiation stage (20-40 days after sowing depending on altitude).
- **Option 2:** Apply the entire dose of suphala and MoP as basal dressing, then top-dress the urea immediately before the first irrigation, at crown root initiation stage (20-40 days after sowing depending on altitude).
- To avoid unproductive tillering and secondary shoots, restrict nutrient supply (especially N) to early growth stages (i.e. start of tillering).
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Maize	1.80	49.50	22.50	57.60	108.00	141.00	96.00	141.00	59.00	58.00

- **Option 1:** Apply the entire dose of SSP, MoP and $^1/_3$ urea as a basal dressing. Top-dressed $^1/_3$ urea at 35-40 days after planting (knee high stage) and the remaining $^1/_3$ at 60-70 days (tasseling stage).
- **Option 2:** Apply the entire dose of suphala, MoP as basal dressing. Top-dress half urea at 35-40 days after planting (knee high stage) and the remaining half at 60-70 days (tasseling stage).
- Use FYM 2-3 tonnes per acre at land preparation.

Fertilizer recommendation for potato

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizers (Option 1)			Fertilizers (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Potato	6.95	43.43	17.37	55.59	94.00	109.00	92.00	109.00	57.00	63.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Top-dressed half urea at earthing up when the leaves are about 10-15 cm long, or at tuber initiation.
- **Option 2:** Apply the entire dose of suphala and MoP and $^1/_3$ urea as basal dressing, then top-dress the remaining at earthing up when the leaves are about 10-15 cm long, or at tuber initiation.
- Potato uses large amounts of N, frequently more than the total applied as fertilizer. Therefore, it is advised to be applied in at least two to three spilt applications. However, excess N at or before tuberization can delay tuber growth and reduce yields.
- Potato requires high levels of available soil K. Potassium is relatively immobile in the soil. For best results, K fertilizers should be applied pre-plant and mixed into the seedbed.
- Phosphorus (P) is immobile in soil and therefore does not move from where it is placed. P fertilizers should either be mixed into the seedbed before planting or banded at planting.
- Place fertilizers close to but not in contact with seed tubers for more efficient fertilizer use.
- Use FYM 5 tonnes per acre at land preparation.

Fertilizer recommendation for vegetables

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Chilli (rainfed)	30.00	20.70	27.00	65.00	129.00	45.00	129.00	20.00	10.00
Chilli (irrigated)	24.00	27.60	30.00	52.00	169.00	50.00	150.00		19.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 top-dressings at 30 and 60 days after planting.
- **Option 2:** Apply entire suphala as a basal dressing.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	SSP
Cauliflower	48.00	27.60	16.00	104.00	173.00	27.00	100..	70.00	73.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 30 and 60 days after planting.
- **Option 2:** Apply suphala and MoP as a basal dressing. Split the urea into 2 parts and top-dress at 30 and 60 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)									
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)			
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP	SSP
Cabbage	46.00	23.00	12.00	100.00	144.00	20.00	75.00	74.00		69.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 30 and 45 days after planting.
- **Option 2:** Apply suphala, and SSP as a basal dressing. Split the urea into 2 parts and top-dress at 30 and 45 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Tomato	22.50	5.75	22.50	49.00	36.00	37.00	36.00	36.00	28.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 20 and 45 days after planting.
- **Option 2:** Apply suphala, and MoP, as a basal dressing. Split the urea into 2 parts and top-dress at 20 and 45 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Time	Fertilizer Recommendations (kg/ac)									
		Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)			
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP	SSP
Asparagus 1st year 2nd year	Basal Side	30.00 70.00	30.00 46.00	16.00 80.00	65.00 152.00	188.00 288.00	27.00 133.00	100.00 288.00	30.00 52.00	57.00	88.00
Apply 2-3 tonnes of FYM /compost at transplanting. From the 2nd year, side dress fertilizer											
Beans	Basal	17.50	40.00	60.00	38.00	250.00	100.00	109.00		71.00	141.00
Apply 2-3 tonnes of FYM. Grows on wide range of soils, pH 5.5-6.8. Legume needs little N.											
Brinjal	Basal TD	20.00 20.00	28.00	12.00	43.00 43.00	175.00	20.00	75.00	17.00 43.00		100.00
Apply 4-5 tonnes of FYM.TD 30 DAT											
Carrot	Basal	10.00	4.00	24.00	22.00	25.00	40.00	25.00	13.00	33.00	
Apply 4-5 tonnes of FYM. Needs K for proper development of roots.											

Chinese Cabbage	Basal TD1 TD2	30.00 10.00 10.00	30.00	16.00	65.00 22.00 22.00	188.00	27.00	100.00	30.00 22.00 22.00		88.00
Apply 5-6 tonnes of FYM. Requires well-drained soils, pH 6-6.8. 1st top dressing 30 DAT 2nd top dressing 60 DAT											
Cucumber	Basal TD	20.00 18.00	40.00	30.00	43.00 39.00	250.00	50.00	125.00	39.00	17.00	125.00
Apply 8-10 tonnes of FYM. Requires good moisture & FYM/OM. Loamy soils best, pH 5.5-6.8. Top dress 4-6 weeks after planting.											
Lettuce	Basal	10.00	16.00	8.00	22.00	100.00	14.00	50.00	4.00		50.00
Apply 2-3 Mt of FYM. Needs continuous moisture so irrigation /water source essential											
Onion	Basal TD	20.00 30.00	30.00	36.00	43.00 65.00	188.00	60.00	125.00	65.00	27.00	63.00
Apply 5 tonnes of FYM. Grows on any soil with good FYM/OM. Bulbs may be poor on heavy wet soils. Optimum pH 6.0-6.8. Top-dress 30 DAP.											
Pea	Basal	25.00	32.00	35.00	54.00	200.00	58.00	156.00		17.00	44.00
Apply 2-3 tonnes of FYM. Grows on all soils, except if waterlogged or compacted. Legume so needs little N.											
Radish	Basal	25.00	16.00	30.00	54.00	100.00	50.00	100.00	20.00	23.00	
Apply 2-3 tonnes of FYM. Grows best in light OM-rich soil pH 6.6-6.8.											
Saag and Spinach	Basal	38.00	30.00	30.00	83.00	188.00	50.00	188.00	17.00		
Apply 8-10 tonnes of FYM. Grow well in all soils; prefer well drained and adequate FYM/OM. pH 6-6.8.											
NB: TD = Top dressing; DAP = Days after planting; DAT = Days after transplanting FYM = farmyard manure; OM = Organic matter e.g. FYM, compost, leaf litter											

Fertilizer Recommendation for Fruit trees and plantation crops

Pome fruits	Plant Nutrient	Non-Bearing trees (g/tree/yr)		Bearing trees (g/tree/yr)		Matured trees	
		Nutrient	Fertilizer	Nutrient	Fertilizer	Nutrient	Fertilizer (g)
Apple Pear	N	69	150g Urea	72	157g Urea	92	200g Urea
	P_2O_5	16	100g SSP	32	200g SSP	48	300g SSP
	K_2O	75	125g MoP	110	183g MoP	150	250g MoP
		Using suphala: Apply suphala: 100g, urea: 115g and MoP: 44g		Using suphala; Apply suphala: 213g, urea: 30g and MoP: 100g		Using suphala; Apply suphala: 213g, urea: 30g and MoP: 100g	
	Using single fertilizer split N application, half in December-February with full P, K or suphala, others half in June. Irrigate/moisten the soils after fertilizer application. FYM to be applied upon availability.						

Stone fruits	Plant Nutrient	Non-Bearing trees (g/tree/yr)		Bearing trees (g/tree/yr)	
		Nutrient	Fertilizer	Nutrient	Fertilizer
Peach Plum Apricot Cherry	N	60	130g Urea	60	120g Urea
	P_2O_5	42	263g SSP	42	263g SSP
	K_2O	90	149g MoP	120	199g MoP
	Using suphala: Apply suphala: 269g, urea: 37g and MoP: 78g			Using suphala: Apply suphala: 263g, urea: 39g and MoP: 129g	
	Using single fertilizer split N application, half in December-February with full P, K or suphala, others half in June. Irrigate /moisten the soils after fertilizer application. FYM to be applied based upon availability.				

14.15 Trashigang Dzongkhag

Soil nutrient status

	pH	OM%	Total N%	AvP (mg/kg)	AvK (mg/kg)	Texture
Rating class	5.30	2.86	0.26	15.44	87.70	Clay Loam
	Very Acidic	Medium	Medium	Medium	Low	

The soil pH is very acidic (refer to lime recommendation section 5). Except available potassium, that is low in the soil, other parameters namely organic matter, total nitrogen, and available phosphorus are within the medium range. The soil texture is clay loam.

Fertilizer recommendation for cereals

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizers (Option 1)			Fertilizers (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Rice	2.50	56.25	7.50	46.88	122.00	47.00	78.00	47.00	106.00	65.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the top-dressed urea into 2 equal parts and apply half at 20-35 days after transplanting (DAT) at tillering stage, and the remaining half at 40-50 DAT (panicle initiation stage).
- **Option 2:** Apply the entire dose of suphala, MoP and $^1/_3$ urea as basal dressing, then top-dress the other $^1/_3$ at 20-35 DAT (tillering stage) and the remaining $^1/_3$ at 40-50 DAT (panicle initiation stage).
- Do not apply urea top-dressing when heavy rainfall is expected.
- Do not apply urea on to standing water, under windy conditions before canopy closure, or at midday when the water temperature is highest.
- When top-dressing, close the terrace water inlets and outlets for at least three days.
- Use at least 2-3 tonnes/acre of FYM at land preparation and plough or cultivate it into the soil before sowing, planting or transplanting.

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizer (Option 1)				Fertilizers (Option 2)	
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Wheat	1.20	27.60	12.00	26.40	60.00	75.00	44.00	75.00	34.00	24.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Top-dressed the other half immediately before the first irrigation, at crown root initiation stage (20-40 days after sowing depending on altitude).
- **Option 2:** Apply the entire dose of suphala and MoP as basal dressing, then top-dress the urea immediately before the first irrigation, at crown root initiation stage (20-40 days after sowing depending on altitude).
- To avoid unproductive tillering and secondary shoots, restrict nutrient supply (especially N) to early growth stages (i.e. start of tillering).
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrients			Fertilizer (Option 1)				Fertilizers (Option 2)	
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	MoP	SSP
Buckwheat	6.00	10.00	8.00	13.00	63.00	13.00	38.00		25.00

- **Option 1:** Apply the entire dose of SSP, MoP and urea as a basal dressing.
- **Option 2:** Apply the entire dose of suphala and MoP as basal dressing.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Maize	1.80	45.00	18.00	66.24	98.00	113.00	110.00	113.00	59.00	80.00

- **Option 1:** Apply the entire dose of SSP, MoP and $^1/_3$ urea as a basal dressing. Top-dressed $^1/_3$ urea at 35-40 days after planting (knee high stage) and the remaining $^1/_3$ at 60-70 days (tasseling stage).
- **Option 2:** Apply the entire dose of suphala, MoP as basal dressing. Top-dress half urea at 35-40 days after planting (knee high stage) and the remaining half at 60-70 days (tasseling stage).
- Use FYM 2-3 tonnes per acre at land preparation.

Fertilizer recommendation for potato

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizers (Option 1)			Fertilizers (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Potato	5.01	31.34	10.03	50.14	66.00	63.00	83.00	63.00	46.00	67.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Top-dressed half urea at earthing up when the leaves are about 10-15 cm long, or at tuber initiation.
- **Option 2:** Apply the entire dose of suphala and MoP and $^1/_3$ urea as basal dressing, then top-dress the remaining at earthing up when the leaves are about 10-15 cm long, or at tuber initiation.
- Potato uses large amounts of N, frequently more than the total applied as fertilizer. Therefore, it is advised to be applied in at least two to three spilt applications. However, excess N at or before tuberization can delay tuber growth and reduce yields.
- Potato requires high levels of available soil K. Potassium is relatively immobile in the soil. For best results, K fertilizers should be applied pre-plant and mixed into the seedbed.
- Phosphorus (P) is immobile in soil and therefore does not move from where it is placed. P fertilizers should either be mixed into the seedbed before planting or banded at planting.
- Place fertilizers close to but not in contact with seed tubers for more efficient fertilizer use.
- Use FYM 5 tonnes per acre at land preparation.

Fertilizer recommendation for vegetables

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Chilli (rainfed)	24.00	18.00	22.50	52.00	113.00	37.00	113.00	13.00	7.00
Chilli (irrigated)	28.00	24.00	30.00	61.00	150.00	50.00	150.00	9.00	10.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 top-dressings at 30 and 60 days after planting.
- **Option 2:** Apply entire suphala as a basal dressing and top-dressed urea after 30 days.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Cauliflower	40.00	24.00	40.00	87.00	150.00	66.00	150.00	35.00	27.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 30 and 60 days after planting.
- **Option 2:** Apply suphala and MoP as a basal dressing. Split the urea into 2 parts and top-dress at 30 and 60 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)									
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)			
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP	SSP
Cabbage	40.00	20.00	30.00	87.00	125.00	50.00	125.00	43.00	17.00	

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 30 and 45 days after planting.
- **Option 2:** Apply suphala, MoP, SSP as a basal dressing. Split the urea into 2 parts and top-dress at 30 and 45 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Tomato	18.75	5.00	18.75	41.00	31.00	31.00	31.00	30.00	23.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 20 and 45 days after planting.
- **Option 2:** Apply suphala, and MoP, as a basal dressing. Split the urea into 2 parts and top-dress at 20 and 45 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Time	Fertilizer Recommendations (kg/ac)									
		Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)			
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP	SSP
Asparagus 1st year 2nd year	 Basal Side	 30.00 50.00	 30.00 46.00	 16.00 80.00	 65.00 109.00	 188.00 288.00	 27.00 133.00	 100.00 288.00	 30.00 9.00	 56.00	88.00
Apply 2-3 tonnes of FYM /compost at transplanting. From the 2nd year, side dress fertilizer											
Beans	Basal	14.00	40.00	66.00	30.00	250.00	110.00	88.00		86.00	163.00
Apply 2-3 tonnes of FYM. Grows on wide range of soils, pH 5.5-6.8. Legume needs little N.											

Brinjal	Basal TD	12.00 20.00	28.00	13.20	26.00 43.00	175.00	22.00	75.00	2.00 43.00		100.00
Apply 4-5 tonnes of FYM.TD 30 DAT											
Carrot	Basal	8.00	4.00	26.40	17.00	25.00	44.00	25.00	9.00	37.00	
Apply 4-5 tonnes of FYM. Needs K for proper development of roots.											
Chinese Cabbage	Basal TD1 TD2	20.00 10.00 10.00	30.00	17.60	43.00 22.00 22.00	188.00	29.00	110.00	5.00 22.00 22.00		78.00
Apply 5-6 tonnes of FYM. Requires well-drained soils, pH 6-6.8. 1st top dressing 30 DAT 2nd top dressing 60 DAT											
Cucumber	Basal TD	20.00 10.00	40.00	33.00	43.00 22.00	250.00	55.00	125.00	22.00	22.00	125.00
Apply 8-10 tonnes of FYM. Requires good moisture & FYM/OM. Loamy soils best, pH 5.5-6.8. Top dress 4-6 weeks after planting.											
Lettuce	Basal	8.00	16.00	8.80	17.00	100.00	15.00	50.00		1.00	50.00
Apply 2-3 tonnes of FYM. Needs continuous moisture so irrigation /water source essential											
Onion	Basal TD	20.00 20.00	30.00	33.00	43.00 43.00	188.00	55.00	125.00	43.00	22.00	63.00
Apply 5 tonnes of FYM. Grows on any soil with good FYM/OM. Bulbs may be poor on heavy wet soils. Optimum pH 6.0-6.8. Top-dress 30 DAP.											
Pea	Basal	20.00	32.00	38.50	43.00	200.00	64.00	125.00		31.00	75.00
Apply 2-3 tonnes of FYM. Grows on all soils, except if waterlogged or compacted. Legume so needs little N.											
Radish	Basal	20.00	16.00	33.00	43.00	100.00	55.00	100.00	9.00	28.00	
Apply 2-3 tonnes of FYM. Grows best in light OM-rich soil pH 6.6-6.8.											
Saag and Spinach	Basal	30.00	30.00	33.00	65.00	188.00	55.00	188.00		5.00	
Apply 8-10 tonnes of FYM. Grow well in all soils; prefer well drained and adequate FYM/OM. pH 6-6.8.											
NB: TD = Top dressing; DAP = Days after planting; DAT = Days after transplanting FYM = farmyard manure; OM = Organic matter e.g. FYM, compost, leaf litter											

Fertilizer recommendation for fruit trees and plantation crops

Fruit tree	Plant Nutrient	Non-Bearing trees (g/tree/yr)		Bearing trees (g/tree/yr)	
		Nutrient	Fertilizer	Nutrient	Fertilizer
Citrus	N	75	163g Urea	200	435g Urea
	P_2O_5	35	219g SSP	75	469g SSP
	K_2O	150	249g MoP	350	581g MoP
		Using suphala: Apply suphala: 219g, urea: 87g and MoP: 191g		Using suphala: Apply suphala: 469g, urea: 272g and MoP: 457g	
	Fertilizer application: After harvest & prior to spring flush. FYM to be applied based upon availability				

14.16 Trashiyangtse Dzongkhag

Soil nutrient status

Rating class	pH	OM%	Total N%	AvP (mg/kg)	AvK (mg/kg)	Texture
	5.55	2.36	0.10	15.85	78.98	Clay Loam
	Slightly Acidic	Medium	Low	Medium	Low	

The soil pH is slightly acidic. The organic matter and available phosphorus are within the medium range. Whereas, the total nitrogen and available potassium are in the low range. The soil texture is clay loam.

Fertilizer recommendation for cereals

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizers (Option 1)			Fertilizers (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Rice	2.50	56.25	7.50	46.88	122.00	47.00	78.00	48.00	106.00	65.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the top-dressed urea into 2 equal parts and apply half at 20-35 days after transplanting (DAT) at tillering stage, and the remaining half at 40-50 DAT (panicle initiation stage).
- **Option 2:** Apply the entire dose of suphala, MoP and $^1/_3$ urea as basal dressing, then top-dress the other $^1/_3$ at 20-35 DAT (tillering stage) and the remaining $^1/_3$ at 40-50 DAT (panicle initiation stage).
- Do not apply urea top-dressing when heavy rainfall is expected.
- Do not apply urea on to standing water, under windy conditions before canopy closure, or at midday when the water temperature is highest.
- When top-dressing, close the terrace water inlets and outlets for at least three days.
- Use at least 2-3 tonnes/acre of FYM at land preparation and plough or cultivate it into the soil before sowing, planting or transplanting.

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizer (Option 1)				Fertilizers (Option 2)	
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Wheat	1.20	30.36	12.00	26.40	66.00	75.00	44.00	75.00	40.00	24.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Top-dressed the other half immediately before the first irrigation, at crown root initiation stage (20-40 days after sowing depending on altitude).
- **Option 2:** Apply the entire dose of suphala and MoP as basal dressing, then top-dress the urea immediately before the first irrigation, at crown root initiation stage (20-40 days after sowing depending on altitude).
- To avoid unproductive tillering and secondary shoots, restrict nutrient supply (especially N) to early growth stages (i.e. start of tillering).
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrients			Fertilizer (Option 1)				Fertilizers (Option 2)	
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Millet	24.00	11.00	12.00	52.00	69.00	20.00	69.00	28.00	2.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing and, apply the other half urea 30-40 days after sowing
- **Option 2:** Apply the entire dose of suphala and MoP and, apply urea as top-dressing 30-40 days after sowing.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Maize	1.80	49.50	18.00	66.24	108.00	113.00	110.00	113.00	68.00	80.00

- **Option 1:** Apply the entire dose of SSP, MoP and $^1/_3$ urea as a basal dressing. Top-dressed $^1/_3$ urea at 35-40 days after planting (knee high stage) and the remaining $^1/_3$ at 60-70 days (tasseling stage).
- **Option 2:** Apply the entire dose of Suphala, MoP as basal dressing. Top-dress half urea at 35-40 days after planting (knee high stage) and the remaining half at 60-70 days (tasseling stage).
- Use FYM 2-3 tonnes per acre at land preparation.

Fertilizer recommendation for potato

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizers (Option 1)			Fertilizers (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Potato	6.24	38.97	12.47	62.35	85.00	78.00	104.00	78.00	58.00	83.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Top-dressed half urea at earthing up when the leaves are about 10-15 cm long, or at tuber initiation.
- **Option 2:** Apply the entire dose of suphala and MoP and $^1/_3$ urea as basal dressing, then top-dress the remaining at earthing up when the leaves are about 10-15 cm long, or at tuber initiation.
- Potato uses large amounts of N, frequently more than the total applied as fertilizer. Therefore, it is advised to be applied in at least two to three spilt applications. However, excess N at or before tuberization can delay tuber growth and reduce yields.
- Potato requires high levels of available soil K. Potassium is relatively immobile in the soil. For best results, K fertilizers should be applied pre-plant and mixed into the seedbed.
- Phosphorus (P) is immobile in soil and therefore does not move from where it is placed. P fertilizers should either be mixed into the seedbed before planting or banded at planting.
- Place fertilizers close to but not in contact with seed tubers for more efficient fertilizer use.
- Use FYM 5 tonnes per acre at land preparation.

Fertilizer recommendation for vegetables

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Chilli (rainfed)	27.26	18.00	22.50	59.00	113.00	37.00	113.00	20.00	7.00
Chilli (irrigated)	32.20	24.00	30.00	70.00	150.00	50.00	150.00	18.00	10.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 top-dressings at 30 and 60 days after planting.
- **Option 2:** Apply entire suphala as a basal dressing.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Cauliflower	46.00	24.00	40.00	100.00	150.00	66.00	150.00	48.00	27.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 30 and 60 days after planting.
- **Option 2:** Apply suphala and MoP as a basal dressing. Split the urea into 2 parts and top-dress at 30 and 60 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)									
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)			
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP	SSP
Cabbage	46.00	20.00	30.00	100.00	125.00	50.00	125.00	57.00	17.00	

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 30 and 45 days after planting.
- **Option 2:** Apply suphala and MoP as a basal dressing. Split the urea into 2 parts and top-dress at 30 and 45 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Tomato	22.50	5.00	18.75	49.00	31.00	31.00	31.00	38.00	23.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 20 and 45 days after planting.
- **Option 2:** Apply suphala and MoP, as a basal dressing. Split the urea into 2 parts and top-dress at 20 and 45 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Time	Fertilizer Recommendations (kg/ac)									
		Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)			
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP	SSP
Asparagus 1st year 2nd year	 Basal Side	 30.00 70.00	 30.00 46.00	 16.00 80.00	 65.00 152.00	 188.00 288.00	 27.00 133.00	 100.00 288.00	 30.00 52.00	 56.00	 88.00
Apply 2-3 tonnes of FYM /compost at transplanting. From the 2nd year, side dress fertilizer											
Beans	Basal	17.50	40.00	66.00	38.00	250.00	110.00	109.00		81.00	141.00
Apply 2-3 tonnes of FYM. Grows on wide range of soils, pH 5.5-6.8. Legume needs little N.											
Brinjal	Basal TD	20.00 20.00	28.00	13.20	43.00 43.00	175.00	22.00	83.00	15.00 43.00		93.00
Apply 4-5 tonnes of FYM.TD 30 DAT											
Carrot	Basal	10.00	4.00	26.40	22.00	25.00	44.00	25.00	13.00	37.00	
Apply 4-5 tonnes of FYM. Needs K for proper development of roots.											
Chinese Cabbage	Basal TD1 TD2	20.00 10.00 10.00	30.00	17.60	43.00 22.00 22.00	188.00	29.00	110.00	5.00 22.00 22.00		78.00
Apply 5-6 tonnes of FYM. Requires well-drained soils, pH 6-6.8. 1st top dressing 30 DAT 2nd top dressing 60 DAT											
Cucumber	Basal TD	20.00 17.00	40.00	33.00	43.00 37.00	250.00	55.00	125.00	 37.00	22.00	125.00
Apply 8-10 tonnes of FYM. Requires good moisture & FYM/OM. Loamy soils best, pH 5.5-6.8. Top dress 4-6 weeks after planting.											
Lettuce	Basal	10.00	16.00	8.80	22.00	100.00	15.00	55.00	3.00		45.00
Apply 2-3 tonnes of FYM. Needs continuous moisture so irrigation /water source essential											
Onion	Basal TD	20.00 30.00	30.00	33.00	43.00 65.00	188.00	55.00	125.00	 65.00	22.00	63.00
Apply 5 tonnes of FYM. Grows on any soil with good FYM/OM. Bulbs may be poor on heavy wet soils. Optimum pH 6.0-6.8. Top-dress 30 DAP.											
Pea	Basal	25.00	32.00	38.50	54.00	200.00	64.00	156.00		22.00	44.00
Apply 2-3 tonnes of FYM. Grows on all soils, except if waterlogged or compacted. Legume so needs little N.											
Radish	Basal	25.00	16.00	33.00	54.00	100.00	55.00	100.00	20.00	28.00	
Apply 2-3 tonnes of FYM. Grows best in light OM-rich soil pH 6.6-6.8.											
Saag and Spinach	Basal	37.50	30.00	33.00	82.00	188.00	55.00	188.00	16.00	5.00	
Apply 8-10 tonnes of FYM. Grow well in all soils; prefer well drained and adequate FYM/OM. pH 6-6.8.											
NB: TD = Top dressing; DAP = Days after planting; DAT = Days after transplanting FYM = farmyard manure; OM = Organic matter e.g. FYM, compost, leaf litter											

14.17 Trongsa Dzongkhag

Soil nutrient status

	pH	OM%	Total N%	AvP (mg/kg)	AvK (mg/kg)	Texture
Rating class	5.58	4.84	0.23	14.15	87.93	Clay Loam
	Slightly Acidic	Medium	Medium	Low	Low	

The soil pH is slightly acidic, optimum for the growth of the most of the agricultural crops. The organic matter and total nitrogen levels are within the medium range. However, the available phosphorus and potassium levels are low in the soil. The soil texture is clay loam.

Fertilizer recommendation for cereals

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrients			Fertilizers (Option 1)			Fertilizers (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Rice	56.25	9.38	46.88	122.00	59.00	78.00	59.00	102.00	62.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the top-dressed urea into 2 equal parts and apply half at 20-35 days after transplanting (DAT) at tillering stage, and the remaining half at 40-50 DAT (panicle initiation stage).
- **Option 2:** Apply the entire dose of suphala, MoP and $^1/_3$ urea as basal dressing, then top-dress the other $^1/_3$ at 20-35 DAT (tillering stage) and the remaining $^1/_3$ at 40-50 DAT (panicle initiation stage).
- Do not apply urea top-dressing when heavy rainfall is expected.
- Do not apply urea on to standing water, under windy conditions before canopy closure, or at midday when the water temperature is highest.
- When top-dressing, close the terrace water inlets and outlets for at least three days.
- Use at least 2-3 tonnes/acre of FYM at land preparation and plough or cultivate it into the soil before sowing, planting or transplanting.

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizer (Option 1)				Fertilizers (Option 2)	
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Wheat	1.20	27.60	13.80	26.40	60.00	86.00	44.00	86.00	30.00	21.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Top-dressed the other half immediately before the first irrigation, at crown root initiation stage (20-40 days after sowing depending on altitude).
- **Option 2:** Apply the entire dose of suphala and MoP as basal dressing, then top-dress the urea immediately before the first irrigation, at crown root initiation stage (20-40 days after sowing depending on altitude).
- To avoid unproductive tillering and secondary shoots, restrict nutrient supply (especially N) to early growth stages (i.e. start of tillering).
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrients			Fertilizer (Option 1)				Fertilizers (Option 2)	
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	MoP	SSP
Buckwheat	6.00	14.00	8.00	13.00	88.00	13.00	38.00	3.00	50.00

- **Option 1:** Apply the entire dose of SSP, MoP and urea as a basal dressing.
- **Option 2:** Apply the entire dose of suphala, MoP and SSP as basal dressing.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrients			Fertilizer (Option 1)				Fertilizers (Option 2)	
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	MoP	SSP
Barley	4.50	18.00	18.00	10.00	113.00	30.00	28.00	22.00	84.00

- **Option 1:** Apply the entire dose of SSP, MoP and urea as a basal dressing.
- **Option 2:** Apply the entire dose of suphala, MoP, and SSP as basal dressing.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Maize	1.80	45.00	22.50	66.24	98.00	141.00	110.00	141.00	49.00	73.00

- **Option 1:** Apply the entire dose of SSP, MoP and $^1/_3$ urea as a basal dressing. Top-dressed $^1/_3$ urea at 35-40 days after planting (knee high stage) and the remaining $^1/_3$ at 60-70 days (tasseling stage).
- **Option 2:** Apply the entire dose of suphala, MoP as basal dressing. Top-dress half urea at 35-40 days after planting (knee high stage) and the remaining half at 60-70 days (tasseling stage).
- Use FYM 2-3 tonnes per acre at land preparation.

Fertilizer recommendation for potato

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizers (Option 1)			Fertilizers (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Potato	5.57	34.78	13.91	55.65	76.00	87.00	92.00	87.00	45.00	69.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Top-dressed half urea at earthing up when the leaves are about 10-15 cm long, or at tuber initiation.
- **Option 2:** Apply the entire dose of suphala and MoP and $^1/_3$ urea as basal dressing, then top-dress the remaining at earthing up when the leaves are about 10-15 cm long, or at tuber initiation.
- Potato uses large amounts of N, frequently more than the total applied as fertilizer. Therefore, it is advised to be applied in at least two to three spilt applications. However, excess N at or before tuberization can delay tuber growth and reduce yields.
- Potato requires high levels of available soil K. Potassium is relatively immobile in the soil. For best results, K fertilizers should be applied pre-plant and mixed into the seedbed.
- Phosphorus (P) is immobile in soil and therefore does not move from where it is placed. P fertilizers should either be mixed into the seedbed before planting or banded at planting.

- ❖ Place fertilizers close to but not in contact with seed tubers for more efficient fertilizer use.
- ❖ Use FYM 5 tonnes per acre at land preparation.

Fertilizer recommendation for vegetables

Crop	Fertilizer Recommendations (kg/ac)									
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)			
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP	SSP
Chilli (rainfed)	24.00	22.50	22.50	52.00	141.00	37.00	141.00	3.00		
Chilli (irrigated)	28.00	30.00	30.00	61.00	188.00	50.00	175.00		3.00	13.00

- ❖ **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 top-dressings at 30 and 60 days after planting.
- ❖ **Option 2:** Apply entire suphala, MoP, and SSP as a basal dressing.
- ❖ Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Cauliflower	40.00	30.00	40.00	87.00	188.00	66.00	188.00	22.00	17.00

- ❖ **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 30 and 60 days after planting.
- ❖ **Option 2:** Apply suphala and MoP as a basal dressing. Split the urea into 2 parts and top-dress at 30 and 60 days after planting.
- ❖ Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)									
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)			
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP	SSP
Cabbage	40.00	25.00	30.00	87.00	156.00	50.00	156.00	33.00	8.00	

- ❖ **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 30 and 45 days after planting.
- ❖ **Option 2:** Apply suphala and MoP as a basal dressing. Split the urea into 2 parts and top-dress at 30 and 45 days after planting.
- ❖ Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Tomato	18.75	6.25	18.75	49.00	39.00	31.00	39.00	27.00	21.00

- ❖ **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 20 and 45 days after planting.
- ❖ **Option 2:** Apply suphala, and MoP, as a basal dressing. Split the urea into 2 parts and top-dress at 20 and 45 days after planting.
- ❖ Use FYM 2-3 tonnes per acre at land preparation.

Crop	Time	Fertilizer Recommendations (kg/ac)									
		Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)			
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP	SSP
Asparagus 1st year 2nd year	 Basal Side	 30.00 50.00	 30.00 46.00	 16.00 80.00	 65.00 109.00	 188.00 288.00	 27.00 133.00	 100.00 288.00	 30.00 9.00	 56.00	 88.00
Apply 2-3 tonnes of FYM /compost at transplanting. From the 2nd year, side dress fertilizer											
Beans	Basal	14.00	40.00	66.00	30.00	250.00	110.00	88.00		86.00	163.00
Apply 2-3 tonnes of FYM. Grows on wide range of soils, pH 5.5-6.8. Legume needs little N.											
Brinjal	Basal TD	20.00 12.00	28.00	13.20	43.00 26.00	175.00	22.00	88.00	15.00 26.00		93.00
Apply 4-5 tonnes of FYM.TD 30 DAT											
Carrot	Basal	8.00	4.00	26.40	17.00	25.00	44.00	25.00	9.00	37.00	
Apply 4-5 tonnes of FYM. Needs K for proper development of roots.											
Chinese Cabbage	Basal TD1 TD2	20.00 10.00 10.00	30.00	17.60	43.00 22.00 22.00	188.00	29.00	110.00	5.00 22.00 22.00		78.00
Apply 5-6 tonnes of FYM. Requires well-drained soils, pH 6-6.8. 1st top dressing 30 DAT 2nd top dressing 60 DAT											
Cucumber	Basal TD	20.00 10.00	40.00	33.00	43.00 22.00	250.00	55.00	125.00	 22.00	22.00	125.00
Apply 8-10 tonnes of FYM. Requires good moisture & FYM/OM. Loamy soils best, pH 5.5-6.8. Top dress 4-6 weeks after planting.											
Lettuce	Basal	8.00	16.00	8.80	17.00	100.00	15.00	50.00		1.00	50.00
Apply 2-3 tonnes of FYM. Needs continuous moisture so irrigation /water source essential											
Onion	Basal TD	20.00 30.00	30.00	33.00	43.00 65.00	188.00	55.00	125.00	 65.00	22.00	63.00
Apply 5 tonnes of FYM. Grows on any soil with good FYM/OM. Bulbs may be poor on heavy wet soils. Optimum pH 6.0-6.8. Top-dress 30 DAP.											
Pea	Basal	20.00	32.00	38.50	43.00	200.00	64.00	125.00		31.00	75.00
Apply 2-3 tonnes of FYM. Grows on all soils, except if waterlogged or compacted. Legume so needs little N.											
Radish	Basal	20.00	16.00	33.00	43.00	100.00	55.00	100.00	9.00	28.00	
Apply 2-3 tonnes of FYM. Grows best in light OM-rich soil pH 6.6-6.8.											
Saag and Spinach	Basal	30.00	30.00	33.00	65.00	188.00	55.00	188.00		5.00	
Apply 8-10 tonnes of FYM. Grow well in all soils; prefer well drained and adequate FYM/OM. pH 6-6.8.											
NB: TD = Top dressing; DAP = Days after planting; DAT = Days after transplanting FYM = farmyard manure; OM = Organic matter e.g. FYM, compost, leaf litter											

Fertilizer recommendation for fruit trees and plantation crops

Fruit tree	Plant Nutrient	Non-Bearing trees (g/tree/yr)		Bearing trees (g/tree/yr)	
		Nutrient	Fertilizer	Nutrient	Fertilizer
Citrus	N	75	163g Urea	200	435g Urea
	P_2O_5	50	313g SSP	100	625g SSP
	K_2O	150	249g MoP	350	581g MoP
		Using suphala: Apply suphala: 313g, urea: 54g and MoP: 166g		Using suphala: Apply suphala: 625g, urea: 217g and MoP: 415g	
	Fertilizer application: After harvest & prior to spring flush. FYM to be applied based upon availability				

14.18 Tsirang Dzongkhag

Soil nutrient status

Rating class	pH	OM%	Total N%	AvP (mg/kg)	AvK (mg/kg)	Texture
	5.59	2.67	0.11	31.00	69.90	Loam
	Slightly Acidic	Medium	Low	High	Low	

The soil pH is slightly acidic, optimum for the growth of the most of the agricultural crops. The soil organic matter is within medium range. The available phosphorus is in high range, whereas the total nitrogen and available potassium in within low range. The soil texture is loam.

Fertilizer recommendation for cereals

Crop	Yield taget (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizers (Option 1)			Fertilizers (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Rice (Local)		36.00	4.50	12.00	78.00	28.00	20.00	28.00	68.00	12.00
Rice (Improved)	2.00	45.00	4.50	37.50	98.00	28.00	62.00	28.00	88.00	55.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the top-dressed urea into 2 equal parts and apply half at 20-35 days after transplanting (DAT) at tillering stage, and the remaining half at 40-50 DAT (panicle initiation stage).
- **Option 2:** Apply the entire dose of suphala, MoP and $^1/_3$ urea as basal dressing, then top-dress the other $^1/_3$ at 20-35 DAT (tillering stage) and the remaining $^1/_3$ at 40-50 DAT (panicle initiation stage).
- Do not apply urea top-dressing when heavy rainfall is expected.
- Do not apply urea on to standing water, under windy conditions before canopy closure, or at midday when the water temperature is highest.
- When top-dressing, close the terrace water inlets and outlets for at least three days.
- Use at least 2-3 tonnes/acre of FYM at land preparation and plough or cultivate it into the soil before sowing, planting or transplanting.

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizer (Option 1)				Fertilizers (Option 2)	
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Wheat	1.20	30.36	9.00	26.40	66.00	56.00	44.00	56.00	46.00	29.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Top-dressed the other half immediately before the first irrigation, at crown root initiation stage (20-40 days after sowing depending on altitude).
- **Option 2:** Apply the entire dose of suphala and MoP as basal dressing, then top-dress the urea immediately before the first irrigation, at crown root initiation stage (20-40 days after sowing depending on altitude).
- To avoid unproductive tillering and secondary shoots, restrict nutrient supply (especially N) to early growth stages (i.e. start of tillering).
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrients			Fertilizer (Option 1)				Fertilizers (Option 2)	
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	MoP	SSP
Buckwheat	6.00	6.00	8.00	13.00	38.00	13.00	38.00	3.00	

- **Option 1:** Apply the entire dose of SSP, MoP and urea as a basal dressing.
- **Option 2:** Apply the entire dose of suphala and MoP as basal dressing.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrients			Fertilizer (Option 1)				Fertilizers (Option 2)	
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Millet	24.00	10.00	12.00	52.00	63.00	20.00	63.00	30.00	3.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing and, apply the other half urea 30-40 days after sowing
- **Option 2:** Apply the entire dose of suphala and MoP and, apply urea as top-dressing 30-40 days after sowing.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Maize	1.80	49.50	13.50	66.24	108.00	84.00	110.00	84.00	78.00	88.00

- **Option 1:** Apply the entire dose of SSP, MoP and $^1/_3$ urea as a basal dressing. Top-dressed $^1/_3$ urea at 35-40 days after planting (knee high stage) and the remaining $^1/_3$ at 60-70 days (tasseling stage).
- **Option 2:** Apply the entire dose of suphala, MoP as basal dressing. Top-dress half urea at 35-40 days after planting (knee high stage) and the remaining half at 60-70 days (tasseling stage).
- Use FYM 2-3 tonnes per acre at land preparation.

Fertilizer recommendation for potato

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizers (Option 1)			Fertilizers (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Potato	3.40	21.23	5.90	33.96	46.00	37.00	56.00	37.00	33.00	47.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Top-dressed half urea at earthing up when the leaves are about 10-15 cm long, or at tuber initiation.
- **Option 2:** Apply the entire dose of suphala and MoP and $^1/_3$ urea as basal dressing, then top-dress the remaining at earthing up when the leaves are about 10-15 cm long, or at tuber initiation.
- Potato uses large amounts of N, frequently more than the total applied as fertilizer. Therefore, it is advised to be applied in at least two to three spilt applications. However, excess N at or before tuberization can delay tuber growth and reduce yields.
- Potato requires high levels of available soil K. Potassium is relatively immobile in the soil. For best results, K fertilizers should be applied pre-plant and mixed into the seedbed.

- Phosphorus (P) is immobile in soil and therefore does not move from where it is placed. P fertilizers should either be mixed into the seedbed before planting or banded at planting.
- Place fertilizers close to but not in contact with seed tubers for more efficient fertilizer use.
- Use FYM 5 tonnes per acre at land preparation.

Fertilizer recommendation for vegetables

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Chilli (rainfed)	27.60	13.50	27.00	60.00	84.00	45.00	84.00	31.00	22.00
Chilli (irrigated)	32.20	18.00	36.00	70.00	113.00	60.00	113.00	31.00	30.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 top-dressings at 30 and 60 days after planting.
- **Option 2:** Apply entire suphala as a basal dressing.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Cauliflower	46.00	18.00	48.00	100.00	113.00	80.00	113.00	61.00	50.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 30 and 60 days after planting.
- **Option 2:** Apply suphala and MoP as a basal dressing. Split the urea into 2 parts and top-dress at 30 and 60 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)									
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)			
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP	SSP
Cabbage	46.00	15.00	36.00	100.00	94.00	60.00	94.00	67.00	35.00	

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 30 and 45 days after planting.
- **Option 2:** Apply suphala, MoP, SSP as a basal dressing. Split the urea into 2 parts and top-dress at 30 and 45 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Tomato	22.50	3.75	22.50	48.00	23.00	37.00	23.00	41.00	31.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 20 and 45 days after planting.
- **Option 2:** Apply suphala, and MoP, as a basal dressing. Split the urea into 2 parts and top-dress at 20 and 45 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Time	Fertilizer Recommendations (kg/ac)									
		Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)			
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP	SSP
Asparagus 1st year 2nd year	 Basal Side	 30.00 70.00	 30.00 38.00	 30.00 80.00	 65.00 152.00	 188.00 238.00	 50.00 133.00	 188.00 238.00	 70.00	 70.00	
Apply 2-3 tonnes of FYM /compost at transplanting. From the 2nd year, side dress fertilizer											
Beans	Basal	17.50	36.00	66.00	38.00	225.00	110.00	110.00		81.00	116.00
Apply 2-3 tonnes of FYM. Grows on wide range of soils, pH 5.5-6.8. Legume needs little N.											
Brinjal	Basal TD	20.00 20.00	25.30	13.20	43.00 43.00	158.00	22.00	83.00	15.00 43.00		76.00
Apply 4-5 tonnes of FYM.TD 30 DAT											
Carrot	Basal	10.00	3.60	26.40	22.00	23.00	44.00	23.00	14.00	38.00	
Apply 4-5 tonnes of FYM. Needs K for proper development of roots.											
Chinese Cabbage	Basal TD1 TD2	20.00 15.00 15.00	27.00	17.60	43.00 33.00 33.00	169.00	29.00	110.00	5.00 33.00 33.00		59.00
Apply 5-6 tonnes of FYM. Requires well-drained soils, pH 6-6.8. 1st top dressing 30 DAT 2nd top dressing 60 DAT											
Cucumber	Basal TD	20.00 17.00	36.00	33.00	43.00 37.00	225.00	55.00	125.00	 37.00	22.00	100.00
Apply 8-10 tonnes of FYM. Requires good moisture & FYM/OM. Loamy soils best, pH 5.5-6.8. Top dress 4-6 weeks after planting.											
Lettuce	Basal	10.00	14.40	8.80	22.00	90.00	15.00	55.00	3.00		35.00
Apply 2-3 tonnes of FYM. Needs continuous moisture so irrigation /water source essential											
Onion	Basal TD	20.00 30.00	27.00	33.00	43.00 65.00	169.00	55.00	125.00	 65.00	22.00	44.00
Apply 5 tonnes of FYM. Grows on any soil with good FYM/OM. Bulbs may be poor on heavy wet soils. Optimum pH 6.0-6.8. Top-dress 30 DAP.											
Pea	Basal	25.00	28.80	38.50	54.00	180.00	64.00	157.00		22.00	23.00
Apply 2-3 tonnes of FYM. Grows on all soils, except if waterlogged or compacted. Legume so needs little N.											
Radish	Basal	25.00	14.40	33.00	54.00	90.00	55.00	90.00	23.00	31.00	
Apply 2-3 tonnes of FYM. Grows best in light OM-rich soil pH 6.6-6.8.											
Saag and Spinach	Basal	37.50	27.00	33.00	82.00	169.00	55.00	169.00	23.00	10.00	
Apply 8-10 tonnes of FYM. Grow well in all soils; prefer well drained and adequate FYM/OM. pH 6-6.8.											
NB: TD = Top dressing; DAP = Days after planting; DAT = Days after transplanting FYM = farmyard manure; OM = Organic matter e.g. FYM, compost, leaf litter											

Fertilizer Recommendation for Fruit trees and plantation crops

Fruit tree	Plant Nutrient	Non-Bearing trees (g/tree/yr)		Bearing trees (g/tree/yr)	
		Nutrient	Fertilizer	Nutrient	Fertilizer
Citrus	N	100	217g Urea	250	544g Urea
	P_2O_5	25	156g SSP	50	313g SSP
	K_2O	150	249g MoP	350	581g MoP
		Using suphala: Apply suphala: 157g, urea: 163g and MoP: 208g		Using suphala: Apply suphala: 313g, urea: 435g and MoP: 498g	
	Fertilizer application: After harvest & prior to spring flush. FYM to be applied based upon availability				

14.19 Wangduephodrang Dzongkhag

Soil nutrient status

	pH	OM%	Total N%	AvP (mg/kg)	AvK (mg/kg)	Texture
Rating class	5.91	4.72	0.23	22.58	155.54	Clay Loam
	Slightly Acidic	Medium	Medium	Medium	Medium	

The soil pH is slightly acidic, optimum for the growth of most of the crops. The organic matter, total nitrogen, available phosphorus, and potassium are within the medium range. The soil texture is clay loam.

Fertilizer recommendation for cereals

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizers (Option 1)			Fertilizers (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Rice (Local)		24.00	7.50	14.00	52.00	47.00	23.00	47.00	36.00	11.00
Rice (Improved)	2.50	56.25	7.50	37.50	122.00	47.00	62.00	47.00	106.00	50.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the top-dressed urea into 2 equal parts and apply half at 20-35 days after transplanting (DAT) at tillering stage, and the remaining half at 40-50 DAT (panicle initiation stage).
- **Option 2:** Apply the entire dose of suphala, MoP and $^1/_3$ urea as basal dressing, then top-dress the other $^1/_3$ at 20-35 DAT (tillering stage) and the remaining $^1/_3$ at 40-50 DAT (panicle initiation stage).
- Do not apply urea top-dressing when heavy rainfall is expected.
- Do not apply urea on to standing water, under windy conditions before canopy closure, or at midday when the water temperature is highest.
- When top-dressing, close the terrace water inlets and outlets for at least three days.
- Use at least 2-3 tonnes/acre of FYM at land preparation and plough or cultivate it into the soil before sowing, planting or transplanting.

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizer (Option 1)				Fertilizers (Option 2)	
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Wheat	1.20	27.60	12.00	24.00	60.00	75.00	40.00	75.00	34.00	20.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Top-dressed the other half immediately before the first irrigation, at crown root initiation stage (20-40 days after sowing depending on altitude).
- **Option 2:** Apply the entire dose of suphala and MoP as basal dressing, then top-dress the urea immediately before the first irrigation, at crown root initiation stage (20-40 days after sowing depending on altitude).
- To avoid unproductive tillering and secondary shoots, restrict nutrient supply (especially N) to early growth stages (i.e. start of tillering).
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrients			Fertilizer (Option 1)				Fertilizers (Option 2)	
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	MoP	SSP
Buckwheat	6.00	10.00	6.00	13.00	63.00	10.00	38.00		25.00

- **Option 1:** Apply the entire dose of SSP, MoP and urea as a basal dressing.
- **Option 2:** Apply the entire dose of suphala and SSP as basal dressing.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	MoP	SSP
Barley	4.50	13.00	13.00	5.00	13.00	12.00	28.00	14.00	53.00

- **Option 1:** Apply the entire dose of SSP, MoP and urea as a basal dressing.
- **Option 2:** Apply the entire dose of Suphala, MoP and SSP as a basal dressing.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Maize	1.80	45.00	18.00	57.60	98.00	113.00	96,00	113.00	59.00	66.00

- **Option 1:** Apply the entire dose of SSP, MoP and $^1/_3$ urea as a basal dressing. Top-dressed $^1/_3$ urea at 35-40 days after planting (knee high stage) and the remaining $^1/_3$ at 60-70 days (tasseling stage).
- **Option 2:** Apply the entire dose of suphala, MoP as basal dressing. Top-dress half urea at 35-40 days after planting (knee high stage) and the remaining half at 60-70 days (tasseling stage).
- Use FYM 2-3 tonnes per acre at land preparation.

Fertilizer recommendation for potato

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizers (Option 1)			Fertilizers (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Potato	8.37	52.25	16.73	66.93	114.00	105.00	111.00	105.00	77.00	83.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Top-dressed half urea at earthing up when the leaves are about 10-15 cm long, or at tuber initiation.
- **Option 2:** Apply the entire dose of suphala and MoP and $^1/_3$ urea as basal dressing, then top-dress the remaining at earthing up when the leaves are about 10-15 cm long, or at tuber initiation.
- Potato uses large amounts of N, frequently more than the total applied as fertilizer. Therefore, it is advised to be applied in at least two to three spilt applications. However, excess N at or before tuberization can delay tuber growth and reduce yields.
- Potato requires high levels of available soil K. Potassium is relatively immobile in the soil. For best results, K fertilizers should be applied pre-plant and mixed into the seedbed.
- Phosphorus (P) is immobile in soil and therefore does not move from where it is placed. P fertilizers should either be mixed into the seedbed before planting or banded at planting.

- Place fertilizers close to but not in contact with seed tubers for more efficient fertilizer use.
- Use FYM 5 tonnes per acre at land preparation.

Fertilizer recommendation for mustard

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrients			Fertilizers (Option 1)			Fertilizers (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Mustard	20.00	10.00	10.00	43.00	63.00	17.00	63.00	22.00	

- **Option 1:** Apply the entire dose of SSP, MoP and urea as a basal dressing.
- **Option 2:** Apply the entire dose of suphala and urea as basal dressing.

Fertilizer recommendation for vegetables

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Chilli (rainfed)	24.00	18.00	18.00	52.00	113.00	30.00	113.00	13.00	
Chilli (irrigated)	28.00	24.00	24.00	61.00	150.00	40.00	150.00	9.00	

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 top-dressings at 30 and 60 days after planting.
- **Option 2:** Apply entire suphala as a basal dressing, and top-dressed urea at 30 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Cauliflower	40.00	23.75	32.00	87.00	148.00	53.00	148.00	35.00	14.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 30 and 60 days after planting.
- **Option 2:** Apply suphala and MoP as a basal dressing. Split the urea into 2 parts and top-dress at 30 and 60 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)									
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)			
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP	SSP
Cabbage	40.00	19.75	24.00	87.00	123.00	40.00	123.00	44.00	7.00	

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 30 and 45 days after planting.
- **Option 2:** Apply suphala and MoP as a basal dressing. Split the urea into 2 parts and top-dress at 30 and 45 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Tomato	18.75	5.00	15.00	41.00	31.00	25.00	31.00	30.00	17.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 20 and 45 days after planting.
- **Option 2:** Apply suphala, and MoP, as a basal dressing. Split the urea into 2 parts and top-dress at 20 and 45 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Time	Fertilizer Recommendations (kg/ac)									
		Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)			
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP	SSP
Asparagus 1st year 2nd year	 Basal Side	 20.00 60.00	 30.00 46.00	 30.00 66.00	 43.00 130.00	 188.00 238.00	 50.00 110.00	 125.00 288.00	 30.00	 17.00 33.00	63.00
Apply 2-3 tonnes of FYM /compost at transplanting. From the 2nd year, side dress fertilizer											
Beans	Basal	14.00	40.00	60.00	30.00	250.00	100.00	88.00		76.00	163.00
Apply 2-3 tonnes of FYM. Grows on wide range of soils, pH 5.5-6.8. Legume needs little N.											
Brinjal	Basal TD	20.00 12.00	28.00	12.00	43.00 26.00	175.00	20.00	75.00	17.00 26.00		100.00
Apply 4-5 tonnes of FYM.TD 30 DAT											
Carrot	Basal	8.00	4.00	24.00	17.00	25.00	40.00	25.00	9.00	33.00	
Apply 4-5 tonnes of FYM. Needs K for proper development of roots.											
Chinese Cabbage	Basal TD1 TD2	20.00 10.00 10.00	30.00	16.00	43.00 22.00 22.00	188.00	27.00	100.00	9.00 22.00 22.00		88.00
Apply 5-6 tonnes of FYM. Requires well-drained soils, pH 6-6.8. 1st top dressing 30 DAT 2nd top dressing 60 DAT											
Cucumber	Basal TD	20.00 10.00	40.00	30.00	43.00 22.00	250.00	50.00	125.00	 22.00	17.00	125.00
Apply 8-10 tonnes of FYM. Requires good moisture & FYM/OM. Loamy soils best, pH 5.5-6.8. Top dress 4-6 weeks after planting.											
Lettuce	Basal	8.00	16.00	8.00	17.00	100.00	13.00	50.00			50.00
Apply 2-3 tonnes of FYM. Needs continuous moisture so irrigation /water source essential											
Onion	Basal TD	20.00 20.00	30.00	30.00	43.00 43.00	188.00	50.00	125.00	 43.00	17.00	63.00
Apply 5 tonnes of FYM. Grows on any soil with good FYM/OM. Bulbs may be poor on heavy wet soils. Optimum pH 6.0-6.8. Top-dress 30 DAP.											
Pea	Basal	20.00	32.00	35.00	43.00	200.00	58.00	125.00		25.00	75.00
Apply 2-3 tonnes of FYM. Grows on all soils, except if waterlogged or compacted. Legume so needs little N.											
Radish	Basal	20.00	16.00	30.00	43.00	100.00	50.00	100.00	9.00	23.00	
Apply 2-3 tonnes of FYM. Grows best in light OM-rich soil pH 6.6-6.8.											
Saag and Spinach	Basal	30.00	30.00	30.00	65.00	188.00	50.00	188.00			
Apply 8-10 tonnes of FYM. Grow well in all soils; prefer well drained and adequate FYM/OM. pH 6-6.8.											

NB: TD = Top dressing; DAP = Days after planting; DAT = Days after transplanting
FYM = farmyard manure; OM = Organic matter e.g. FYM, compost, leaf litter

Fertilizer recommendation for fruit trees and plantation crops

Fruit tree	Plant Nutrient	Non-Bearing trees (g/tree/yr)		Bearing trees (g/tree/yr)	
		Nutrient	Fertilizer	Nutrient	Fertilizer
Citrus	N	75	163g Urea	200	435g Urea
	P_2O_5	35	219g SSP	75	469g SSP
	K_2O	125	208g MoP	300	498g MoP
		Using suphala: Apply suphala: 219g, urea: 87g and MoP: 149g		Using suphala: Apply suphala: 469g, urea: 272g and MoP: 374g	
	Fertilizer application: After harvest & prior to spring flush. FYM to be applied based upon availability				

14.20 Zhemgang Dzongkhag

Soil nutrient status

	pH	OM%	Total N%	AvP (mg/kg)	AvK (mg/kg)	Texture
Rating class	5.43	3.83	0.16	37.00	73.18	Loam
	Very Acidic	Medium	Low	High	Low	

The soil pH is very acidic (refer to lime recommendation section 5). The organic matter is within the medium range. The soil contains low levels of total nitrogen and available potassium, whereas the available phosphorus is within the high range. The soil texture is loam.

Fertilizer recommendation for cereals

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizers (Option 1)			Fertilizers (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Rice	2.50	56.25	6.75	46.88	122.00	42.00	78.00	42.00	108.00	67.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the top-dressed urea into 2 equal parts and apply half at 20-35 days after transplanting (DAT) at tillering stage, and the remaining half at 40-50 DAT (panicle initiation stage).
- **Option 2:** Apply the entire dose of suphala, MoP and $^1/_3$ urea as basal dressing, then top-dress the other $^1/_3$ at 20-35 DAT (tillering stage) and the remaining $^1/_3$ at 40-50 DAT (panicle initiation stage).
- Do not apply urea top-dressing when heavy rainfall is expected.
- Do not apply urea on to standing water, under windy conditions before canopy closure, or at midday when the water temperature is highest.
- When top-dressing, close the terrace water inlets and outlets for at least three days.
- Use at least 2-3 tonnes/acre of FYM at land preparation and plough or cultivate it into the soil before sowing, planting or transplanting.

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizer (Option 1)				Fertilizers (Option 2)	
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Wheat	1.20	27.60	10.80	26.40	60.00	68.00	44.00	68.00	37.00	26.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Top-dressed the other half immediately before the first irrigation, at crown root initiation stage (20-40 days after sowing depending on altitude).
- **Option 2:** Apply the entire dose of suphala and MoP as basal dressing, then top-dress the urea immediately before the first irrigation, at crown root initiation stage (20-40 days after sowing depending on altitude).
- To avoid unproductive tillering and secondary shoots, restrict nutrient supply (especially N) to early growth stages (i.e. start of tillering).
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrients			Fertilizer (Option 1)				Fertilizers (Option 2)	
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	MoP	SSP
Buckwheat	6.00	6.00	8.00	13.00	38.00	13.00	38.00	3.00	

- **Option 1:** Apply the entire dose of SSP, MoP and urea as a basal dressing.
- **Option 2:** Apply the entire dose of suphala and MoP as basal dressing.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrients			Fertilizer (Option 1)				Fertilizers (Option 2)	
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Millet	24.00	10.00	12.00	52.00	63.00	20.00	63.00	30.00	3.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing and, apply the other half urea 30-40 days after sowing
- **Option 2:** Apply the entire dose of suphala and MoP and, apply urea as top-dressing 30-40 days after sowing.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Maize	1.80	45.00	14.40	66.24	98.00	90.00	110.00	90.00	67.00	86.00

- **Option 1:** Apply the entire dose of SSP, MoP and $^1/_3$ urea as a basal dressing. Top-dressed $^1/_3$ urea at 35-40 days after planting (knee high stage) and the remaining $^1/_3$ at 60-70 days (tasseling stage).
- **Option 2:** Apply the entire dose of suphala, MoP as basal dressing. Top-dress half urea at 35-40 days after planting (knee high stage) and the remaining half at 60-70 days (tasseling stage).
- Use FYM 2-3 tonnes per acre at land preparation.

Fertilizer recommendation for potato

Crop	Yield target (Mt/ac)	Fertilizer Recommendations (kg/ac)								
		Nutrients			Fertilizers (Option 1)			Fertilizers (Option 2)		
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Potato	3.00	18.75	5.40	30.00	41.00	34.00	50.00	34.00	29.00	41.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Top-dressed half urea at earthing up when the leaves are about 10-15 cm long, or at tuber initiation.
- **Option 2:** Apply the entire dose of suphala and MoP and $^1/_3$ urea as basal dressing, then top-dress the remaining at earthing up when the leaves are about 10-15 cm long, or at tuber initiation.
- Potato uses large amounts of N, frequently more than the total applied as fertilizer. Therefore, it is advised to be applied in at least two to three spilt applications. However, excess N at or before tuberization can delay tuber growth and reduce yields.
- Potato requires high levels of available soil Potassium K. Potassium is relatively immobile in the soil. For best results, K fertilizers should be applied pre-plant and mixed into the seedbed.

- Phosphorus (P) is immobile in soil and therefore does not move from where it is placed. P fertilizers should either be mixed into the seedbed before planting or banded at planting.
- Place fertilizers close to but not in contact with seed tubers for more efficient fertilizer use.
- Use FYM 5 tonnes per acre at land preparation.

Fertilizer recommendation for vegetables

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Chilli (rainfed)	24.00	16.20	22.50	52.00	101.00	37.00	101.00	17.00	10.00
Chilli (irrigated)	28.00	21.60	30.00	61.00	135.00	50.00	135.00	14.00	14.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 top-dressings at 30 and 60 days after planting.
- **Option 2:** Apply entire suphala as a basal dressing.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Cauliflower	40.00	20.40	40.00	87.00	128.00	66.00	128.00	43.00	33.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 30 and 60 days after planting.
- **Option 2:** Apply suphala and MoP as a basal dressing. Split the urea into 2 parts and top-dress at 30 and 60 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)									
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)			
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP	SSP
Cabbage	40.00	16.00	30.00	87.00	100.00	50.00	100.00	52.00	23.00	

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 30 and 45 days after planting.
- **Option 2:** Apply suphala and MoP as a basal dressing. Split the urea into 2 parts and top-dress at 30 and 45 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Tomato	18.75	4.50	18.75	41.00	28.00	31.00	28.00	31.00	24.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 parts and top-dress at 20 and 45 days after planting.
- **Option 2:** Apply suphala, and MoP as a basal dressing. Split the urea into 2 parts and top-dress at 20 and 45 days after planting.
- Use FYM 2-3 tonnes per acre at land preparation.

Crop	Time	Fertilizer Recommendations (kg/ac)									
		Nutrient			Fertilizer (Option 1)			Fertilizer (Option 2)			
		N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP	SSP
Asparagus 1st year 2nd year	 Basal Side	 20.00 60.00	 22.00 46.00	 40.00 66.00	 43.00 130.00	 138.00 288.00	 66.00 110.00	 125.00 288.00	 30.00	 33.00 33.00	13.00
Apply 2-3 tonnes of FYM /compost at transplanting. From the 2nd year, side dress fertilizer											
Beans	Basal	14.00	36.00	66.00	30.00	225.00	110.00	88.00		86.00	138.00
Apply 2-3 tonnes of FYM. Grows on wide range of soils, pH 5.5-6.8. Legume needs little N.											
Brinjal	Basal TD	20.00 12.00	25.20	13.20	43.00 26.00	158.00	22.00	83.00	15.00 26.00		75.00
Apply 4-5 tonnes of FYM.TD 30 DAT											
Carrot	Basal	8.00	4.50	26.40	17.00	28.00	44.00	28.00	8.00	36.00	
Apply 4-5 tonnes of FYM. Needs K for proper development of roots.											
Chinese Cabbage	Basal TD1 TD2	20.00 10.00 10.00	27.00	17.60	43.00 22.00 22.00	169.00	29.00	110.00	5.00 22.00 22.00		59.00
Apply 5-6 tonnes of FYM. Requires well-drained soils, pH 6-6.8. 1st top dressing 30 DAT 2nd top dressing 60 DAT											
Cucumber	Basal TD	20.00 10.00	36.00	33.00	43.00 22.00	225.00	55.00	125.00	 22.00	22.00	100.00
Apply 8-10 tonnes of FYM. Requires good moisture & FYM/OM. Loamy soils best, pH 5.5-6.8. Top dress 4-6 weeks after planting.											
Lettuce	Basal	8.00	14.40	8.80	17.00	90.00	15.00	50.00		1.00	40.00
Apply 2-3 tonnes of FYM. Needs continuous moisture so irrigation /water source essential											
Onion	Basal TD	20.00 20.00	27.00	33.00	43.00 43.00	169.00	55.00	125.00	 43.00	22.00	44.00
Apply 5 tonnes of FYM. Grows on any soil with good FYM/OM. Bulbs may be poor on heavy wet soils. Optimum pH 6.0-6.8. Top-dress 30 DAP.											
Pea	Basal	20.00	28.80	38.50	43.00	180.00	64.00	125.00		31.00	55.00
Apply 2-3 tonnes of FYM. Grows on all soils, except if waterlogged or compacted. Legume so needs little N.											
Radish	Basal	20.00	14.40	33.00	43.00	90.00	55.00	90.00	12.00	31.00	
Apply 2-3 tonnes of FYM. Grows best in light OM-rich soil pH 6.6-6.8.											
Saag and Spinach	Basal	30.00	27.00	33.00	65.00	169.00	55.00	169.00	7.00	10.00	
Apply 8-10 tonnes of FYM. Grow well in all soils; prefer well drained and adequate FYM/OM. pH 6-6.8.											
NB: TD = Top dressing; DAP = Days after planting; DAT = Days after transplanting FYM = farmyard manure; OM = Organic matter e.g. FYM, compost, leaf litter											

Fertilizer recommendation for fruit trees and plantation crops

Fruit tree	Plant Nutrient	Non-Bearing trees (g/tree/yr)		Bearing trees (g/tree/yr)	
		Nutrient	Fertilizer	Nutrient	Fertilizer
Citrus	N	75	163g Urea	200	435g Urea
	P_2O_5	25	156g SSP	50	313g SSP
	K_2O	150	249g MoP	350	581g MoP
		Using suphala: Apply suphala: 156g, urea: 109g and MoP: 208g		Using suphala: Apply suphala: 313g, urea: 326g and MoP: 498g	
	Fertilizer application: After harvest & prior to spring flush. FYM to be applied based upon availability				

15. General fertilizer Recommendation

15.1 Fertilizer recommendation for Quinoa

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrients			Fertilizers (Option 1)			Fertilizers (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Quinoa	30.00	20.00	20.00	65.00	125.00	33.00	125.00	22.00	

- **Option 1:** Apply the entire dose of SSP, MoP and urea as a basal dressing.
- **Option 2:** Apply the entire dose of suphala and urea as basal dressing.

15.2 Fertilizer recommendation for hybrid Vegetables

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrients			Fertilizers (Option 1)			Fertilizers (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Chilli (HPH 1069)	90.00	45.00	60.00	196.00	281.00	100.00	281.00	98.00	25.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 top-dressings at 30 and 60 days after planting.
- **Option 2:** Apply entire suphala as a basal dressing. Split the urea into 2 top-dressings and apply at 30 and 60 days after planting.
- Use FYM 5 tonnes per acre at land preparation.

For winter chilli, use the same fertilizer rates with the guidelines stated below:

- **Option 1:** Apply the entire dose of SSP, $^2/_3$ MoP and half urea as a basal dressing. Split the other half urea into 2 top-dressings at 30 and 60 days after planting. Apply remaining ($^1/_3$) MoP at 60 days after planting.
- **Option 2:** Apply entire suphala as a basal dressing. Split the urea into 2 top-dressings and apply at 30 and 60 days after planting. Apply MoP at 60 days after planting.
- Use FYM 5 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrients			Fertilizers (Option 1)			Fertilizers (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Chilli (Sitara)	80.00	45.00	90.00	174.00	281.00	149.00	281.00	76.00	75.00

- **Option 1:**
- Urea- 45kg, SSP- 156kg, MoP-50kg as basal dressing.
- Urea- 43kg, SSP- 125kg, MoP-34kg at 30-35 days after first fertilizer application.
- Urea- 43kg, MoP- 42kg at 20-25 days after second fertilizer application.
- Urea- 43kg, MoP- 23kg after 15 days of first picking
- **Option 2:**
- Apply entire suphala as basal dressing
- Split the urea and MoP into 3 top-dressings and apply at 30-35 days after first fertilizer application, 20-25 days after second fertilizer application, and 15 days after first picking.
- Use FYM 5 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrients			Fertilizers (Option 1)			Fertilizers (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Cauliflower	50.00	25.00	35.00	109.00	156.00	58.00	156.00	54.00	17.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 2 top-dressings at 30 and 60 days after planting.
- **Option 2:** Apply entire suphala and MoP as a basal dressing. Split the urea into 2 top-dressings and apply at 30 and 60 days after planting.
- Use FYM 5 tonnes per acre at land preparation.

Crop	Fertilizer Recommendations (kg/ac)								
	Nutrients			Fertilizers (Option 1)			Fertilizers (Option 2)		
	N	P_2O_5	K_2O	Urea	SSP	MoP	Suphala	Urea	MoP
Cauliflower	80.00	30.00	50.00	174.00	188.00	83.00	188.00	109.00	33.00

- **Option 1:** Apply the entire dose of SSP, MoP and half urea as a basal dressing. Split the other half urea into 3 top-dressings at 14, 28, and 42 days after planting.
- **Option 2:** Apply entire suphala and MoP as a basal dressing. Split the urea into 3 top-dressings and apply at 14, 28, 1n3 42 days after planting.
- Use FYM 5 tonnes per acre at land preparation.

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