RAPID SOIL FERTILITY SURVEY & SOIL TESTING INSTITUTE

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No. 8351-8422

Dated 14-06-2021

To

1. All SFOs and ASFOs, Soil Fertility Research Institute, Punjab, Lahore.
2. All Divisional and District Heads/Chemists and Assistant Chemists

Subject: **SFRI-GUIDE-V: SOIL AND WATER DATA INTERPRETATION AND FERTILIZER RECOMMENDATIONS FOR VARIOUS CROPS(2021)**

By the grace of Almighty Allah, who enabled us to write another excellent and much-needed booklet, "SFRI-GUIDE-V: SOIL AND WATER DATA INTERPRETATION AND FERTILIZER RECOMMENDATIONS FOR VARIOUS CROPS (2021)," which is the most pressing need of the hour and almost completely covers all aspects of Soil and Water data interpretation, which is desperately needed for every Agricultural Scientist, This booklet will benefit not only experts, but also university students studying Soil Science, Extension Field officers, and Advanced Growers, all of whom will contribute to the growth of modernized Agriculture. In order to eliminate all flaws in formulating fertilizer recommendations, the lab and field personnel under the Administrative control of the Soil Fertility Research Institute, Punjab Lahore, will strictly follow the guidelines for formulating fertilizer recommendations. This book serves as a ***foundation for soil fertility***, which is a critical need of the hour.

You are required to distribute a copy of this booklet to each scientist working under your Administrative supervision, as well as to the Deputy and Assistant Directors of the Agriculture Extension wing, as well as to the University/ Department library in your respective region, in order to effectively communicate Soil and Water data interpretation and fertilizer recommendations for various crops. This would also be an attempt to bridge the gap between Scientists and Extension workers. It is advisable to provide an acknowledgement to this office in this regard, which will be evaluated during a review meeting or inspection.

You are required to follow all instructions according to guidelines in order to obtain consistent results with minimal variations for strict enforcement in order to improve the precision with which formulating fertilizer recommendations are made more efficient and authenticated which is our primary goal.

13/06/21

(DR MUHAMMAD AKRAM QAZI)
Chief Scientist/ Director
Soil Fertility Research Institute, Punjab,
Lahore

CC.

1. PS to Additional Secretary (Admin), Agriculture Department, Punjab, Lahore.
2. Chief Scientist/Director General Agriculture (Research), AARI, Faisalabad with the request that it should be widely disseminated among the scientists affiliated with AARI, Faisalabad.
3. The Director General Agriculture (Ext & Adaptive Res.), Agriculture House, Davis Road, Lahore with the request to circulate widely among Field Officers of Extension & Adaptive Research working under your administrative control in order to increase awareness and knowledge of soil and water data interpretation and fertilizer recommendations for various crops.

SOIL FERTILITY RESEARCH INSTITUTE PUNJAB, LAHORE
AGRICULTURE DEPARTMENT, GOVERNMENT OF THE PUNJAB
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SFRI-Guide-V	**Soil and water data interpretation and fertilizer recommendations for various crops**	**Issue on**	**13.06.2021**	**Revision**	**0**

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SFRI-GUIDE-V

SOIL AND WATER DATA INTERPRETATION AND FERTILIZER RECOMMENDATIONS FOR VARIOUS CROPS

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■ FOREWORD

Soil and water analysis data is meaningless unless it is interpreted correctly and crop-specific fertilizer doses and recommendations are established. It was also noted that there is some misunderstanding among the Soil and Water Testing Laboratories of Agriculture Department on the guidelines and standards required for evaluating soil and water analysis data and providing fertilizer recommendations. Furthermore, it is time consuming and difficult to interpret soil and water analysis data. The guide is intended to compile the criteria and standards necessary for making meaningful interpretations and fertilizer recommendations for various crops. Over the years, the Soil Fertility Research Institute (SFRI), Punjab, Lahore has established and authenticated these guidelines and standards.

It is critical to remember that, in addition to soil fertility, there are numerous other elements that influence plant growth. Crop yield can be hampered by poor drainage, insects, weeds, drought, disease, and other problems. As a result, all conceivable circumstances should be considered when making an interpretation. Although organic fertilizers have a part in modern agriculture, mineral fertilizers are the principal source of plant nutrition. As a result, the primary objective of this book is to make recommendations on mineral fertilizers. The recommendations and interpretations contained in this book are not intended to replace specialized professional advice on specific difficulties or issues and cannot be used to supersede it. Although this text has been meticulously compiled, any latest developments, flaws, or errors will be greatly welcomed.

I hope you find this SFRI-Guide-V informative, and any comments you have will be very appreciated if they help to improve it.

Chief Scientist/Director,
Soil Fertility Research Institute, Punjab, Lahore

■ ACKNOWLEDGEMENT

Syed Asad Rehman Gillani, Secretary Agriculture, Punjab deserves official privileges for his vision and dedication in enabling us to create a document that contains all of the necessary guidelines for interpreting soil and water data and making profitable fertilizer recommendations.

■ FUTURE WORK STRATEGY OF SFRI

1. To improve the efficiency of service delivery of all divisional and district labs.
2. In all labs, all laboratory tests will be performed in accordance with uniform standard test methods.
3. To improve the handling of fertilizer samples collected as part of an anti-adulteration campaign for accuracy, repeatability, and reliability.
4. By implementing reforms in the field wing, the institute's original mandate of formulating fertilizer recommendations will be made more efficient and authenticated. In Sha Allah

■ CONTENTS

■ INTRODUCTION

Fertility is a dynamic and ever-changing property of soil. Nutrients are being lost through leaching and erosion, as well as by gaseous emissions into the atmosphere. Some nutrients, such as phosphorus and potassium, are bound up in soil clays. Soil organic matter decomposition first immobilizes and then releases nutrients to the soil. Crop yields also deplete nutrients. The repercussions of soil mining triggered by all of these factors may take many years to manifest. According to Justus von Liebig's 1862 " Law of the Minimum," a lack of any one critical plant nutrient can limit a plant's yield even though all other nutrients are available in appropriate proportions. As a result, it is critical to apply the appropriate type and quantity of fertilizer at the appropriate time in order to maintain or improve soil fertility. One of the aims of the Soil Fertility Research Institute (SFRI), Punjab, Lahore is to determine the fertilizer requirements for various crops across the province of Punjab in various agro ecological zones. This goal is accomplished through collaboration between SFRI's laboratory and field wings.

Although the Soil and Water Testing Laboratories under the control of SFRI are ISO 17025:2017 accredited by the Pakistan National Accreditation Council (PNAC) in Islamabad, this does not guarantee that the results interpretations or fertilizer recommendations based solely on soil analysis data are accurate. Without the field calibration on which the studies are based, it is impossible to interpret the results meaningfully. Local data and information on fertilizer response are critical when making fertilizer recommendations. This is why SFRI's field wing conducts calibration studies on farmers' fields and collects data on soil type, rainfall, crop monitoring throughout the growing season, and crop response to fertilizer application. All of this information has been utilized to develop validated interpretation criteria for each soil quality parameter and to make fertilizer recommendations over the years.

DR MUHAMMAD AKRAM QAZI
Chief Scientist/Director,
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SFRI CRITERIA FOR THE INTERPRETATION OF SOIL AND WATER PARAMETERS OBTAINED FROM CALIBRATION EXPERIMENTS

A variety of chemical, physical, and biological criteria can be used to determine the quality of soil for sustainable agriculture. Chemical parameters include the electrical conductivity (EC) of the soil, the pH of the soil, and the nutrients available to the plants. The most frequently utilized physical measure for evaluating soil quality is soil texture.

■ SOIL PHYSICAL PARAMETERS

These soil characteristics are used to assess and forecast soil constraints on plant growth. Not only do soil physical characteristics explain the transport of plant nutrients through the soil, but they are also applied to make soil management decisions and carry out agronomic activities. These soil quality indicators should be interpreted in conjunction with other chemical measurements.

■ Soil Texture

Soil texture refers to the proportion of sand, silt, and clay in a soil. These are the soil's building blocks and have a significant impact on the soil's qualities. This parameter is typically used to determine the soil's capability to retain water and nutrients, as well as its subsurface compaction and erodibility. The percentage of soil saturated and the texture of the soil have a close relationship. Table 1 serves as a guide for determining the soil texture class based on the saturation percentage.

Table 1. Soil Textural Classification Based on Saturation (%)

Saturation (%)	Textural Class	
Up to 19	Sand	ریتلی
20 - 30	Sandy Loam	ریتلی میرا
31 - 45	Loam	میرا سے درمیانی بھاری میرا
46 - 60	Clay Loam	بھاری میرا یا چکنی
more than 60	Clay	چکنی
Source: Malik *et al.*, 1984		

Table 2: Interpretation of Soil Texture

Texture	Interpretation	Recommendations
Sand	Slight physical restriction to root growth. Soil moisture stress could be a problem because water is drained rapidly out of root zone.	Chickpea, groundnuts, and millet can be grown successfully.
Sandy Loam	Root growth is not restricted. Soil water is available to most crops. Water drains from the soil readily but not rapidly.	Chickpea, groundnuts, and millet can be grown successfully
Loam	Root growth is not restricted. It has moderate susceptibility to mechanical compaction.	Almost all crops can be grown.
Clay Loam	Root growth is not restricted. It has moderate susceptibility to mechanical compaction.	Suitable for sugarcane and rice crops
Clay	Root growth of most species is moderately to severely restricted. Water drains very slowly and my cause periodic water logging.	--
Source: (Malik *et al.*, 1984), (McDonald *et al.*, 1998)		

■ Particles with Coarse Differentiations and Stratifications

These are calcium carbonate, iron, or gypsum mineral depositions in soil. These particles come in a variety of shapes, sizes, and forms and they have a significant impact on the chemical and physical properties of soil. Calcium carbonate is most commonly seen as nodules, which can be confirmed with the addition of hydrochloric acid. Because the reaction between acid and calcium carbonate creates effervescence, this test is popularly referred to as the "fizz" test. A high concentration could impede water permeability and limit root growth. Alkaline conditions are created by high concentrations, which decrease the availability of some nutrients to plants.

Table 3: Interpretation of Calcium Carbonate Fragments in Soil

Calcium Carbonate Proportion / Form	Interpretation

Calcium Carbonate Proportion / Form	Interpretation
Fine soil carbonate in clay, a few calcrete fragments are present	It restricts the drainage and cause poor root growth.
Sheet or boulder calcrete	It is hard and softens only after prolonged irrigation. Drainage and root growth is restricted in calcrete sheet however, boulder form exhibit good root growth.
Compact mixture of finely divided carbonate, sandy loam to sandy clay loam. Contains < 30 % calcrete fragments	Drainage and root growth is medium to poor.
Adopted and modified from Peverill *et al.*, 1999.	

■ SOIL CHEMICAL PROPERTIES

Salinity, sodicity, and soil reaction (pH) all have a significant effect on plant development and agricultural production. Sufficient nutrient supply is facilitated by a suitable chemical environment.

■ Soil pH

The pH value indicates the acidity or alkalinity of the soil as determined by the activity of hydrogen ions (H^+). It establishes the solubility and reactivity of soil elements. Soil pH is usually interpreted in conjunction with other soil data such as EC and soil texture. Table below summarizes the critical pH ranges when no other limiting factor for plant growth, such as salinity, exists.

Table 4: Generalized Interpretation of Soil pH Measured in Saturated Soil Paste

Soil pH (Saturated Soil Paste)	Amelioration
7 to 7.5	All nutrients are easily available to plant. Soils are likely to be most productive providing there is no nutrient deficiency.
7.6 to 8.0	The plant availability of Zn, Fe, and B decreases. Plants needs to be monitored.
8.1 to 8.5	Plant availability of phosphorous and micronutrients except Mo decreases significantly.
More than 8.5	It is possible that trace elements will be required. The soil may be saline if the EC is greater than 4 dS/m. If the EC is less than 4dS/m, sodicity is present, and gypsum should be used.

Source: (Malik *et al*., 1984)

■ Soil Salinity

Salinity is caused by the accumulation of water-soluble salts in soil. Generally, the level of soil salinity is determined by the electrical conductivity (EC) of saturated soil extract. The decisiemens per metre (dS/m) unit is used to express the EC of soil extracts and is numerically comparable to the millisiemens per centimetre (mS/cm) and millimho per centimetre (mmho/cm) units. One decisiemens per metre (dS/m) is equal to 1000 microsiemens per centimetre (S/cm).

Table 5: Salinity Levels for Soils Based on EC_e

ECe (dS/m)	Salinity level	Effect on plant
Less than 2	Non-Saline	Salinity effects are mostly negligible
2 – 4	Slightly saline	Yield of sensitive crops can be affected
4.1 – 8	Moderately saline	Yield of most of the crops is affected
8.1 – 16	Highly saline	Tolerant crops are the only ones that produce satisfactorily.
More than 16	Extremely saline	Highly tolerant crops are the only ones that produce satisfactorily.
Source: (Malik *et al*., 1984)		

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■ Soil Sodicity

Sodicity is a term that refers to the amount of exchangeable sodium cations in soil. It is calculated using the sodium adsorption ratio (SAR), which is a measure of the activity of sodium ions in comparison to calcium and magnesium ions. Soils or water with a high sodium activity in comparison to calcium and magnesium will have a high ESP and be sodic. Although the pH value of the soil can be used to assess its amount of sodicity because there is a general relationship between sodicity and pH, other measures such as ECe, SAR, and ESP are also used to identify salt-affected soils.

Table 6: Classification of Salt-Affected Soils

Parameter	Saline soil	Nonsaline-Alkali/sodic soil	Saline-sodic soil
Soil EC_e	$\geq$ 4 mS/cm	Variable, mostly < 4 mS/cm	> 4 mS/cm
Soil pH_s	< 8.5	$\geq$ 8.5	$\geq$ 8.5
ESP	< 15	$\geq$ 15	$\geq$ 15
SAR	< 13.2	$\geq$ 13.2	$\geq$ 13.2
Source: Adapted from *(Richards, 1954) and (Malik* et al., *1984)*			

■ Soil Organic Matter (SOM)

The term "soil organic matter" refers to the total amount of organic material, including dissolved, particulate, humus, and inert organic matter. The Walkley and Black (1934) method is used to estimate SOM at the soil and water testing laboratories of the agriculture department. The majority of analytical methods for estimating SOM, including the Walkley and Black technique, begin with the determination of soil organic carbon (SOC), which is then transformed to SOM using a conversion factor of 1.72.

SOM (g/Kg soil) = SOC (g/kg soil) x 1.72

It is critical to note that the SOM values in Table 7 are intended to be used as a guideline only, as SOM is composed of a variety of components. Organic fraction contributions have not yet been proven.

Table 7:Guidelines for Evaluating Soil Fertility Status

Soil quality parameter	Category		
	Poor	Medium	Adequate
Soil organic matter (%)	<0.86	0.87 - 1.29	>1.29
Available Phosphorous (mg P/Kg)	<7	7 - 14	>14
Available potassium (mg /Kg soil)	<80	80 - 180	>180
Source: (Malik *et al.*, 1984)			

Table 8: Guidelines for Evaluating DTPA-Extractable Micronutrient Status

DTPA-extractable Micronutrient (mg/Kg)	Category		
	Poor	Medium	Adequate
Zinc (Zn)	<0.5	0.5 - 1.0	>1.0
Copper (Cu)	<0.1	0.1 - 0.2	>0.2
Iron (Fe)	<2.0	2 - 4.5	>4.5
Manganese (Mn)	<0.5	0.5 – 1.0	>1.0
Boron (B)	<0.2	0.2 – 0.5	0.5 -1.0
Source: Unpublished data of Rapid Soil Fertility Survey and Soil Testing Institute, Punjab, Lahore			

■ General guidelines for Interpreting Soil Analysis Data

The recommendations made to farmers regarding the use of fertilizer to achieve a desired yield are predictive, and their utility is contingent on a variety of interrelated financial and agronomic factors. This section contains some guidelines for assessing soil data and providing recommendations.

- • In some cases, different soil tests are employed to determine the availability of the same nutrient. Zinc, for instance, is extracted from soil using DTPA (diethylene triamine pent acetic acid) as well as AB-DTPA (ammonium bicarbonate-DTPA). Both tests have distinct zinc interpretation criteria. Such distinctions should be taken into account when interpreting and making recommendations.
- Criteria and recommendations of interpretation of fertilizer may vary with crop, soil, weather, seasonal duration (sowing time), etc. For example, a low concentration of extractable P, Fe, or other elements in one crop may not necessarily be low in another crop due to the roots system and rhizosphere chemistry being different. Similarly, crop response to fertilizer application may differ according on soil type (spatial variability). Similarly, meteorological conditions have an effect on plant nutrient uptake and utilization. As a result, local information is critical for making site-specific recommendations.

- Generally, recommendations are based on surface soil (0-15cm) test findings; however, literature indicates that subsoil (15-30cm) can be a significant source of some plant nutrients. As a result, understanding of subsoil conditions would be beneficial.
- Take into account the cost of fertilizer and anticipate the market price of produce. This will decide the farm's return on investment in fertilizer. The primary goal should be to optimize financial returns on fertilizer investments by using efficient and sustainable nutrient management practices.

Using the soil test and crop nutrient requirements to calculate fertilizer recommendations

The soil test, a key soil test value or crop fertilizer demand, and the bulk density estimate of the soil test layer are all necessary for fertilizer recommendation. A key soil test value and fertilizer needs are estimated by constructing a link between crop yield and soil test value. Correlations can be extrapolated to regions with comparable soil and crop potential. The process of calculating is described as below.

1. Determine the soil rank based on the soil test result, such as low, medium, or adequate.
2. Determine the crop's nutrient need (Kg/acre) depending on the soil rank.
3. Convert the nutrient content of the soil sample (mg nutrient/kg soil) to available nutrient Kg per acre. If 1 acre-foot soil layer weighs 1 million kilogrammes, then mg/Kg equals Kg/acre.
4. Using the calculation below, determine the Kg nutrient per acre that is required.

Top-up plus maintenance fertilizer requirement (Kg nutrient/acre) = Fertilizer requirement of crop – Soil Test

Table 9: Illustration of estimating fertilizer recommendation for wheat (irrigated)

Crop	Soil P Test Ranking	Nutrient required** (kg/acre)	Minus	Nutrient Tested (assumed) (ppm or kg/acre)*	equals	Nutrient needed (Kg/acre)
Wheat (irrigated)	Poor < 7ppm	46 Kg P/acre	-	6 Kg P/acre	=	40 Kg P
	Medium 7-14	34 Kg P/acre	-	13 Kg P/acre	=	21 Kg P
	Adequate >14	30 Kg P/acre	-	16 Kg P/acre	=	14 Kg P

*The weight of 1 acre-foot soil layer is assumed as 1 million Kg

**Value calculated from correlation between yield and fertilizer applied.

■ Guidelines for Interpreting Water Analysis Data

Electrical Conductivity (EC), Total Soluble Salts (TSS), Sodium Adsorption Ratio (SAR), and Residual Sodium Carbonate (RSC) are some of the quality indicators for irrigation water.

■ Electrical Conductivity

The salinity status of irrigation water is estimated from its EC values.

Table 10: Guidelines for Interpreting Water Salinity

Water class	EC dS/m	EC mS/cm	EC µS/cm	EC mmho/cm	TDS (mg/L or ppm) assuming NaCl is major salt
Non-saline	0 - 1	0 - 1	0 – 1000	0 – 1000	Up to 640
Slightly saline	1 - 1.25	1 - 1.25	1001 - 1250	1001 - 1250	641 - 800
Highly saline	> 1.25	>1.25	>1250	>1250	>800
Source: (Malik *et al.*, 1984)					

■ Total Soluble Salts

Previously, total soluble salts (TSS) were employed to determine the salinity of soil and water, and they are still cited in some studies. The TSS is represented in mg/L or ppm units. The number and nature of salts present in a water solution determines the conductivity of the solution. In general, bigger ions have lower conductivity than smaller, singly charged ions at the same concentration. As a result, depending on the type of salt present, the conversion TSS from EC values will differ. The conversion shown here is for a sodium chloride-dominated salt. As a result, the following table summarizes the general conversion of electrical conductivity to salt concentration or total dissolved solids (TDS).

Total Soluble Salts in water sample (ppm) = 0.7 x EC (µS/cm)
Total cation (or anion) concentration, $mmol_c/L$ = 10 x EC (dS/m)

■ Sodium Adsorption Ratio

It is the relative proportion of Na to Ca + Mg and calculated by following formulae.

$$\textbf{SAR} = \frac{\textbf{Na}}{[\ (\textbf{Ca} + \textbf{Mg})/2\ ]^{1/2}}$$

■ **Residual Sodium Carbonate**

It is calculated by subtracting Ca + Mg from CO_3+HCO_3 values

RSC me/L = (CO_3 +HCO_3) - (Ca +Mg)

Table 11: SFRI guidelines and interpretation for irrigation water quality

Water Quality Indicator	Status	Guideline values	Interpretation
EC (µS/cm)	Suitable	< 1000	Water is suitable for irrigation. All crops can be grown.
	Marginal	1000 – 1250	It can be used along with canal water on alternate basis. Moderately salt tolerant crops such as wheat, rice, maize, tomato, potato, cabbage, carrot, peas, and onion can be grown.
	Unsuitable	>1250	It can be used in sandy soils with additional soil management practices. Salt tolerant crops such as cotton, sugarcane and spinach can be grown.
SAR	Suitable	< 6	Water is suitable for irrigation. All crops can be grown.
	Marginal	6 – 10	This water will cause sodicity and water infiltration problems in soils having saturation percentage >50% (Clay loam and Clay)
	Unsuitable	>10	This water can be used in soils having saturation percentage < 20 % (Sand)
RSC (me/L)	Suitable	< 1.25	Water is suitable for irrigation. All crops can be grown.
	Marginal	1.25 - 2.5	Moderately salt tolerant crops can be grown.
	Unsuitable	>2.5	This water will cause sodicity and water infiltration problems.
Cl^{-1} (me/L)	Suitable	<4.5	Water is suitable for irrigation.
	Unsuitable	> 4.5	Water is unfit for irrigation.
Source: (Malik *et al.*, 1984)			

■ RECOMMENDATIONS

■Marginally saline water

- **Irrigate below leaves:** Leaves of some plants are more sensitive to water salinity than soil salinity, particularly when water is supplied directly to the leaves via a sprinkler. It is advised to irrigate below the leaves when using moderately saline water for sprinkler irrigation. It will prevent salts from being deposited on leaves.
- **Irrigate during night times:** Climate has an effect on how plants respond to salinity. Plants may withstand salt better in cool, humid weather than in hot, dry weather. Irrigate at night to minimize the quantity of salt left on leaves owing to evaporation, which may be greater during the day due to quick evaporation.
- On a rotating basis, use marginally fit water and canal water..

NUTRIENT/ FERTILIZER REQUIREMENTS OF DIFFERENT CROPS

Sr. No.	Name of Crops	Details	Nutrients (kg/acre)			Bags/acre			Dose and time of application without compost	Time and Dose of fertilizer with Compost on P_2O_5 basis IPNM (20:80)***
			N	P_2O_5	K_2O	Urea	DAP	SOP		
1	**Wheat (Irrigated)**	Poor soil	64	46	25	2.00	2.00	1.00	2 bags DAP + 1 bag Urea + 1 bag SOP at the time of sowing. One bag Urea at the time of 1st or 2nd irrigation	Compost=610 kg, 1.75 bags DAP + 1.00 bag Urea + 0.60 bag SOP at the time of sowing. 0.75 bag Urea at the time of 1st or 2nd irrigation
		Medium soil	54	34	25	1.75	1.50	1.00	1.5 bags DAP + 1.0 bags urea + 1 bag SOP at the time of sowing. 0.75 bag Urea at the time of 1st or 2nd irrigation.	Compost=450 kg, 1.2 bags DAP + 0.60 bags urea + 0.75 bag SOP at the time of sowing. 1.00 bag Urea at the time of 1st or 2nd irrigation.
		Fertile soil	46	30	25	1.50	1.25	1.00	1.25 Bag DAP + 0.50 bags Urea + 1 bag SOP at the time of sowing. 1.0 bag Urea at the time of 1st or 2nd irrigation.	Compost=400 kg, 1.0 Bag DAP + 0.50 bags Urea + 0.75 bag SOP at the time of sowing. 0.8 bag Urea at the time of 1st or 2nd irrigation.
	Wheat (Barani)	Low rainfall areas (<350mm)	34	23	12	1.00	1.00	0.50	1.0 bag DAP + 1.0 bag Urea + 0.50 bag SOP before sowing.	Compost=300 kg, 0.80 bag DAP + 1.0 bag Urea + 0.30 bag SOP before sowing.
		Medium rainfall areas (350-600mm)	40	28	12	1.25	1.25	0.50	1.25 bags DAP +1.25 bag Urea + 0.50 bag SOP before sowing.	Compost=370 kg, 1.0 bags DAP +1.1 bag Urea + 0.26 bag SOP before sowing.
		High rainfall areas (>600mm)	48	34	25	1.50	1.50	1.00	1.50 bags DAP +1.00 bag Urea + 0.50 bag SOP before sowing, 0.50 bag Urea at rainfall	Compost=450 kg, 1.2 bags DAP +1.30 bag Urea + 0.75 bag SOP before sowing, 0.30 bag at rainfall

Sr. No.	Name of Crops	Details	Nutrients (kg/acre)			Bags/acre			Dose and time of application without compost	Time and Dose of fertilizer with Compost on P_2O_5 basis IPNM (20:80)***
			N	P_2O_5	K_2O	Urea	DAP	SOP		
2	**Rice (Coarse varieties)**		69	41	32	2.25	1.75	1.25	1.0 bag urea + 1.75 bags DAP + 1.25 bags SOP at the time of puddling and 1.25 bags urea 30-35 days after transplanting	Compost=550 kg, 1.1 bag urea + 1.4 bags DAP + 1.0 bags SOP at the time of puddling and 1.0 bags urea 30-35 days after transplanting
	Rice (Basmati varieties)		55	36	25	1.75	1.50	1.00	1.00 bag urea + 1.50 bags DAP + 1.00 bag SOP at puddling, and 0.75 bag urea after 30-35 days of transplanting	Compost=480 kg, 0.60 bag urea + 1.25 bags DAP + 0.70 bag SOP at puddling, and 1.0 bag urea before 15th of August
3	**BT Cotton, Markazi area***	Poor Soil	100	40	38	3.50	1.75	1.50	1 bag urea + 1.75 bags DAP+1.50 bag SOP at the time of sowing. 1.25 bag urea at first irrigation and 1.25 bag urea at flowering.	Compost=530 kg, 1 bag urea + 1.40 bags DAP+1.20 bag SOP at the time of sowing. 1.25 bag urea at first irrigation and 1.00 bag urea at flowering.
		Medium Soil	90	35	38	3.32	1.50	1.50	1.0 bag urea + 1.50 bags DAP+1.50 bag SOP at the time of sowing. 1.30 bag urea at first irrigation and 1.00 bag urea at flowering.	Compost=470 kg, 1.0 bag urea + 1.2 bags DAP+1.25 bag SOP at the time of sowing. 1.10 bag urea at first irrigation and 1.00 bag urea at flowering.
		Fertile Soil	80	30	38	2.97	1.30	1.50	1.0 bag urea + 1.25 bags DAP+1.50 bag SOP at the time of sowing. 0.75 bag urea at first irrigation and 0.75 bag urea at flowering.	Compost=400 kg, 0.80 bag urea + 1.0 bags DAP+1.25 bag SOP at the time of sowing. 1.0 bag urea at first irrigation and 1.0 bag urea at flowering.
	BT Cotton Sanvi Area**	Poor Soil	90	40	30	3.25	1.75	1.25	1.0 bag urea + 1.75 bags DAP+1.25 bag SOP at the time of sowing. 1.00 bag urea at first irrigation and 1.25 bag urea at flowering.	Compost=530 kg, 1.0 bag urea + 1.4 bags DAP+0.90 bag SOP at the time of sowing. 1.00 bag urea at first irrigation and 1.00 bag urea at flowering.

Sr. No.	Name of Crops	Details	Nutrients (kg/acre)			Bags/acre			Dose and time of application without compost	Time and Dose of fertilizer with Compost on P_2O_5 basis IPNM (20:80)***
			N	P_2O_5	K_2O	Urea	DAP	SOP		
		Medium Soil	80	35	30	3.00	1.50	1.25	1.0 bag urea + 1.50 bags DAP+1.25 bag SOP at the time of sowing. 1.00 bag urea at first irrigation and 1.00 bag urea at flowering.	Compost =470 kg, 0.70 bag urea + 1.20 bags DAP+0.90 bag SOP at the time of sowing. 1.00 bag urea at first irrigation and 1.00 bag urea at flowering.
		Fertile Soil	70	30	30	2.50	1.25	1.25	1 bag urea+1.25 bag DAP +1.25 bag SOP at sowing; 0.75 bag urea at 1st irrigation; 0.75 bag urea at flowering.	Compost=400 kg, 0.9 bag urea+1.0 bag DAP +0.90 bag SOP at sowing; 0.75 bag urea at 1st irrigation; 0.75 bag urea at flowering.
4	**Maize (Hybrid)**	Poor Soil	119	69	50	4.00	3.00	2.0	3.0 bags DAP+2.0 bags SOP, 0.25 bag urea at the time of sowing, 0.5 bag urea at 5-6 leaves stage, 1.25 bag urea at 8-10 leave stage and 1.25 bag urea 15 days before flowering	Compost=920 kg, 2.4 bags DAP+1.4 bags SOP, 0.60 bag urea at the time of sowing, 1.0 bag urea at 5-6 leaves stage, 1.0 bag urea at 8-10 leave stage and 1.0 bag urea 15 days before flowering
		Medium Soil	92	58	37	3.00	2.50	1.50	2.5 bags DAP+1.50 bags SOP at the time of sowing, 1.0 bag urea at 5-6 leaves stage, 1.00 bag urea at 8-10 leave stage and 1.00 bag urea 15 days before flowering	Compost=770 kg, 2.0 bags DAP+1.00 bags SOP at the time of sowing, 0.70 bag urea at 5-6 leaves stage, 1.00 bag urea at 8-10 leave stage and 1.00 bag urea 15 days before flowering
		Fertile Soil	75	46	25	2.50	2.00	1.00	2.0 bags DAP+1.00 bags SOP at the time of sowing, 1.00 bag urea at 5-6 leaves stage, 0.75 bag urea at 8-10 leave stage and 0.75 bag urea 15 days before flowering	Compost=610 kg, 1.60 bags DAP+0.6 bags SOP at the time of sowing, 0.75 bag urea at 5-6 leaves stage, 0.75 bag urea at 8-10 leave stage and 0.75 bag urea 15 days before flowering
	Maize (Barani)	Low rainfall areas	34	23	12	1.00	1.00	0.50	1.1 bag urea+1 bag DAP +0.5 bag SOP at sowing	Compost=300 kg, 1.0 bag urea+0.8 bag DAP +0.3 bag SOP at sowing

Sr. No.	Name of Crops	Details	Nutrients (kg/acre)			Bags/acre			Dose and time of application without compost	Time and Dose of fertilizer with Compost on P_2O_5 basis IPNM (20:80)***
			N	P_2O_5	K_2O	Urea	DAP	SOP		
		High rainfall areas	46	34	25	1.50	1.50	1.00	1.5 bag urea+1.5 bag DAP +1.00 bag SOP at sowing	Compost=450 kg, 1.25 bag urea+1.25 bag DAP +0.75 bag SOP at sowing
	Maize (Composite Non-Hybrid)	Poor Soil	92	58	37	3.00	2.50	1.50	2.5 bags DAP+1.50 bags SOP at the time of sowing, 1.00 bag urea at 5-6 leaves stage, 1.00 bag urea at 8-10 leave stage and 1.00 bag urea 15 days before flowering	Compost=770 kg, 2.0 bags DAP+1.00 bags SOP at the time of sowing, 0.70 bag urea at 5-6 leaves stage, 1.00 bag urea at 8-10 leave stage and 1.00 bag urea 15 days before flowering
		Medium Soil	80	46	37	2.75	2.00	1.50	2.0 bags DAP+1.50 bags SOP at the time of sowing, 1.00 bag urea at 5-6 leaves stage, 1.00 bag urea at 8-10 leave stage and 0.75 bag urea 15 days before flowering	Compost=610 kg, 1.60 bags DAP+1.10 bags SOP at the time of sowing, 0.45 bag urea at 5-6 leaves stage, 1.00 bag urea at 8-10 leave stage and 1.0 bag urea 15 days before flowering
		Fertile Soil	70	35	25	2.50	1.50	1.00	1.50 bags DAP+1.00 bags SOP at the time of sowing, 1.00 bag urea at 5-6 leaves stage, 0.75 bag urea at 8-10 leave stage and 0.75 bag urea 15 days before flowering	Compost=470 kg, 1.2 bags DAP+0.75 bags SOP at the time of sowing, 0.75 bag urea at 5-6 leaves stage, 0.75 bag urea at 8-10 leave stage and 0.75 bag urea 15 days before flowering
	Maize (Fodder)	Medium soil	43	23	12.5	1.50	1.00	0.50	1.00 bag urea+1.00 bag DAP, 0.5 bag SOP at the time of sowing. 0.50 bag Urea at 8-10 leaves stage	Compost=300 kg, 0.80 bag DAP+ 0.30 bag SOP+0.5 bag urea at the time of sowing. 0.80 bag Urea at 8-10 leaves stage
5	**Sugarcane (Spring crop)**	Poor Soil	120	69	50	4.00	3.00	2.00	Add 3 bag DAP, 2 bag SOP, 1 bag Urea in furrows before sowing and one bag urea each in April, May and end of June at earthing up.	Compost=920 kg, + 2.4 bag DAP, 1.5 bag SOP, 0.7 bag Urea in furrows before sowing and one bag urea each in April, May and end of June at earthing up.
		Medium Soil	103	57	50	3.50	2.50	2.00	Add 2.5 bag DAP, 2 bag SOP, 1 bag	Compost=760 kg, Add 2.0 bag DAP,

Sr. No.	Name of Crops	Details	Nutrients (kg/acre)			Bags/acre			Dose and time of application without compost	Time and Dose of fertilizer with Compost on P_2O_5 basis IPNM (20:80)***
			N	P_2O_5	K_2O	Urea	DAP	SOP		
									urea in furrows before sowing and 2.5 bags urea in three equal splits in April, May and End June at earthing up.	1.5 bag SOP, 0.7 bag urea in furrows before sowing and 2.5 bags urea in three equal splits in April, May and End June at earthing up.
		Fertile Soil	87	46	50	3.00	2.00	2.00	Add 2.0 bag DAP, 2 bag SOP, 1 bag Urea in furrows before sowing and 2 bags urea in three equal splits in April, May and End June at earthing up.	Compost=610 kg, 1.60 bag DAP, 1.6 bag SOP, 0.75 bag Urea in furrows before sowing and 2 bags urea in three splits in April, May and End June at earthing up.
	Sugarcane (Ratoon crop)	Poor Soil	156	69	50	5.50	3.00	2.00	2.00 bag urea+ 3.0 bag DAP+ 2.0 bag SOP at first irrigation and 1.75 bag urea each in April and June at earthing up	Compost=920 kg, 1.75 bag urea+ 2.40 bag DAP+ 1.45 bag SOP at first irrigation and 1.75 bag urea each in April and June at earthing up
		Medium Soil	134	57	50	5.25	2.50	2.00	1.75 bag urea+ 2.5 bag DAP+ 2.0 bag SOP at first irrigation and 1.75 bag urea each in April and June at earthing up	Compost=760 kg, 1.5 bag urea+ 2.0 bag DAP+ 1.50 bag SOP at first irrigation and 1.5 bag urea each in April and June at earthing up
		Fertile Soil	113	46	50	4.10	2.00	2.00	1.50 bag urea+ 2.0 bag DAP+ 2.0 bag SOP at first irrigation and 1.3 bag urea each in April and June at earthing up	Compost=610 kg, 1.30 bag urea+ 1.60 bag DAP+ 1.60 bag SOP at first irrigation and 1.3 bag urea each in April and June at earthing up
6	**Potatoes**	-	100	50	50	3.50	2.25	2.00	2.25 bags DAP + 1.50 bag Urea + 2 bags SOP + 10 kg Zinc Sulphate (21%) at the sowing. One bag Urea 30 days after germination and 1 bag Urea 60 days after germination.	Compost=670 kg, 1.75 bags DAP + 1.25 bag Urea + 1.6 bags SOP + 10 kg Zinc Sulphate (21%) at the sowing. One bag Urea 30 days after germination and 1 bag Urea 60 days after germination.
7	**Sesame**	-	34	24	12	1.00	1.00	0.50	1 bag DAP and 0.50 bag SOP at the	Compost=320 kg, 0.8 bag DAP and

Sr. No.	**Name of Crops**	**Details**	**Nutrients (kg/acre)**			**Bags/acre**			**Dose and time of application without compost**	**Time and Dose of fertilizer with Compost on P_2O_5 basis IPNM (20:80)*** **
			N	**P_2O_5**	**K_2O**	**Urea**	**DAP**	**SOP**		
									time of sowing and 0.50 bag urea at first irrigation and 0.50 bag urea at the time of second irrigation	0.30 bag SOP at the time of sowing and 0.40 bag urea at first irrigation and 0.50 bag urea at the time of second irrigation
8	**Mash**	-	9	23	12	-	1.00	0.50	1.00 bag DAP and 0.50 bag SOP at sowing	Compost=300 kg, 0.8 bag DAP and 0.30 bag SOP at sowing
9	**Mung**	-	9	23	12	-	1.00	0.50	1.00 bag DAP and 0.50 bag SOP at sowing	Compost=300 kg, 0.8 bag DAP and 0.30 bag SOP at sowing
10	**Lentil**	-	13	23	12	0.25	1.00	0.50	0.25 bag urea+1.00 bag DAP, 0.50 bag SOP at the time of sowing.	Compost=300 kg, 0.8 bag DAP and 0.30 bag SOP at the time of sowing.
11	**Groundnut**	Low rainfall areas (<350mm)	6	12	6	0	0.75	0.25	0.5 bag DAP+0.25 bag SOP all at sowing	Compost=160 kg, 0.4 bag DAP+0.10 bag SOP all at sowing
		Medium rainfall areas (350-600mm)	8	24	8	0	1.00	0.33	1.0 bag DAP+0.33 bag SOP all at sowing	Compost=320 kg, 0.80 bag DAP+0.10 bag SOP all at sowing
		High rainfall areas (>600mm)	12	32	12	0	1.50	0.50	1.5 bag DAP+0.50 bag SOP all at sowing	Compost=430 kg, 1.1 bag DAP+0.20 bag SOP all at sowing
12	**Gram**	-	13	34	12	0	1.5	0.50	1.50 bag DAP+0.5 bag SOP at sowing	Compost=450 kg, 1.2 bag DAP+0.20 bag SOP at sowing
13	**Sunflower**	Poor Soil	60	40	25	2.00	1.75	1.00	1.75 bags DAP +1.00 bags SOP at the time of sowing. 0.50 bag Urea at first irrigation, 1.0 bags at second irrigation and 0.50 bag Urea at flowering.	Compost=530 kg, 1.4 bags DAP +0.7 bags SOP at the time of sowing. 0.50 bag Urea at first irrigation, 0.60 bags at second irrigation and 0.60 bag Urea at flowering.
		Medium Soil	48	34	25	1.50	1.50	1.00	1.50 bags DAP +1.00 bags SOP at the time of sowing. 0.50 bag Urea at	Compost=450 kg, 1.2 bags DAP +0.75 bags SOP at the time of sowing.

Sr. No.	Name of Crops	Details	Nutrients (kg/acre)			Bags/acre			Dose and time of application without compost	Time and Dose of fertilizer with Compost on P_2O_5 basis IPNM (20:80)***
			N	P_2O_5	K_2O	Urea	DAP	SOP		
									first irrigation, 0.50 bags at second irrigation and 0.50 bag Urea at flowering.	0.30 bag Urea at first irrigation, 0.50 bags at second irrigation and 0.50 bag Urea at flowering.
14	**Garlic**	-	64	46	25	2.00	2.00	1.00	2.00 bag DAP + 1 bag SOP at sowing and 1.00 bag urea after 30 days of sowing, 1.0 bag urea at bulb formation	Compost=610 kg, 1.6 bag DAP + 0.6 bag SOP at sowing and 1.0 bag urea after 30 days of sowing, 0.75 bag urea at bulb formation
15	**Onion**	-	50	35	35	1.50	1.50	1.25	1.50 bag DAP + 1.25 bag SOP at sowing. 0.75 bag Urea after one month of transplanting and 0.75 bag urea at bulb formation	Compost=470 Kg, 1.25 bag DAP + 1.1 bag SOP at sowing. 0.70 bag Urea after one month of transplanting and 0.70 bag urea at bulb formation
16	**Tomatoes**	(Non-Hybrid)	58	23	32	2.10	1.00	1.25	0.60 bag urea + 1.00 bag DAP + 1.25 bag SOP at the time to sowing; 0.75 bag urea at earthing up and 0.75 bag urea 30 days after earthing up.	Compost=300 kg, 0.50 bag urea + 0.80 bag DAP + 1.1 bag SOP at the time to sowing; 0.75 bag urea at earthing up and 0.75 bag urea 30 days after earthing up.
		Hybrid	90	46	100	3.00	2.00	4.00	1.0 bag Urea +2.0 bags DAP +2.0 bags SOP + 20 kg Zinc Sulphate at sowing; 1.0 bag Urea + 1.0 bag SOP at earthing up; 1.0 bag Urea + 1.0 bag SOP one month after 2nd dose	Compost=610 kg, 0.9 bag Urea +1.60 bags DAP +1.6 bags SOP + 20 kg Zinc Sulphate at sowing; 1.0 bag Urea + 1.0 bag SOP at earthing up; 1.0 bag Urea + 1.0 bag SOP one month after 2nd dose
17	**Chilli**	-	58	23	25	2.0	1.00	1.00	0.5 bag Urea+ 1.0 bag DAP + 1 bag SOP at the time of sowing / transplanting; 0.75 bag Urea after 30 DAT, 0.75 bag urea at flowering	Compost=300 kg, 0.5 bag urea+ 0.80 bag DAP + 0.8 bag SOP at the time of sowing / transplanting; 0.75 bag Urea after 30 DAT, 0.75 bag urea at flowering
18	**Berseem**	-	13	35	0	0	1.50	-	1.50 bags DAP at sowing, add	Compost=470 kg, 1.25 bags DAP at

Sr. No.	Name of Crops	Details	Nutrients (kg/acre)			Bags/acre			Dose and time of application without compost	Time and Dose of fertilizer with Compost on P_2O_5 basis IPNM (20:80)***
			N	P_2O_5	K_2O	Urea	DAP	SOP		
									further N after each cutting	sowing, add further N after each cutting
19	**Lucern**	-	23	35	0	0.50	1.50	-	0.50 bag Urea + 1.50 bags DAP at sowing	Compost=460 kg, 0.25 bag Urea + 1.25 bags DAP at sowing
20	**Oats**	-	60	36	25	2.00	1.50	1.00	1.00 bag Urea + 1.50 bags DAP + 1.00 bag SOP at the time of sowing. 1.00 bag Urea at first irrigation	Compost=480 kg, 0.80 bag Urea + 1.25 bags DAP + 0.70 bag SOP at the time of sowing. 1.00 bag Urea at first irrigation
21	**Jowar / Sorghum**	Seed	20	23	25	0.50	1.00	1.00	1.00 bag DAP + 1.00 bag SOP at the time of sowing; 0.50 bag Urea at the time of second irrigation.	Compost=300 kg, 0.75 bag DAP + 0.80 bag SOP at the time of sowing; 0.40 bag Urea at the time of second irrigation.
		Fodder	32	23	12	1.00	1.00	0.50	0.50 bag Urea + 1.00 bag DAP+0.50 SOP at sowing; 0.50 bag Urea at the time of second irrigation.	Compost=300 kg, 0.40 bag Urea + 0.75 bag DAP+0.30 SOP at sowing; 0.50 bag Urea at the time of second irrigation.
22	**Sada Bahar (Fodder)**	Fodder	20	23	12	1.50	1.00	0.50	0.50 bag Urea + 1.00 bag DAP+0.5 bag SOP at sowing, add additional N after every cutting.	Compost=300 kg, 0.4 bag Urea + 0.80 bag DAP+0.3 bag SOP at sowing, add additional N after every cutting.
23	**Bajra**	Single cut fodder	32	23	12	1.00	1.00	0.50	One bag DAP+0.5 bag SOP at sowing, one bag urea at 30 DAS.	Compost=300 kg, 0.8 bag DAP+0.3 bag SOP at sowing, 0.9 bag urea at 30 DAS.
		Multi cut fodder	20	23	12	0.50	1.00	0.50	One bag DAP+0.5 bag SOP at sowing, 0.5 bag urea after each cutting	Compost=300 kg, 0.8 bag DAP+0.3 bag SOP at sowing, 0.5 bag urea after each cutting
24	**Guara**		32	23	0	1.00	1.00	-	One bag DAP at sowing, one bag Urea at flowering	Compost=300 kg, 0.8 bag DAP at sowing, 0.90 bag Urea at flowering
25	**Cowpeas**		9	23	0	0	1.00		One bag DAP at sowing,	Compost=300 kg, 0.8 bag DAP at

Sr. No.	Name of Crops	Details	Nutrients (kg/acre)			Bags/acre			Dose and time of application without compost	Time and Dose of fertilizer with Compost on P_2O_5 basis IPNM (20:80)***
			N	P_2O_5	K_2O	Urea	DAP	SOP		
										sowing,
26	**Mot Grass**		20	23	25	0.5	1.00	1.00	0.5 bag Urea + 1.0 bag DAP + One bag SOP at sowing. One bag Urea after every cutting	Compost=300 kg, 0.4 bag Urea + 0.80 bag DAP + 0.8 bag SOP at sowing. One bag Urea after every cutting
27	**Rhodes Grass**		20	23	25	0.5	1.00	1.00	0.5 bag Urea + 1.0 bag DAP + One bag SOP at sowing. One bag Urea after every cutting	Compost=300 kg, 0.4 bag Urea + 0.80 bag DAP + 0.80 bag SOP at sowing. One bag Urea after every cutting
28	**Kallar Grass**		20	23	12	0.50	1.00	0.50	0.5 bag Urea + 1.0 bag DAP + 0.5 bag SOP at sowing. One bag Urea after every cutting	Compost=300 kg, 0.4 bag Urea + 0.80 bag DAP + 0.30 bag SOP at sowing. One bag Urea after every cutting
29	**Jantar**		20	23	0	0.5	1.00	-	One bag DAP at sowing+ 0.5 bag Urea at first irrigation	Compost=300 kg, 0.80 bag DAP at sowing+ 0.4 bag Urea at first irrigation
30	**Cowpeas (Rawan)**		9	23	-	-	1.00	-	One bag DAP at sowing	Compost=300 kg, 0.8 bag DAP at sowing

*Markazi area for cotton = Multan, Khanewal, Vehari, Lodhran, Bahawalnagar, Bahawalpur, DG Khan, Rajanpur, Muzzafargarh, Layyah and Rahim Yar Khan
** Sanvi area for cotton = Faisalabad, Toba Tek Singh, Jhang, Chiniot, Sargodha, Bhakkar, Mianwali, Sahiwal, Okara and Pakpattan
*** Compost composition assumed=1.5% N, 1.5% P_2O_5, 1.5% K_2O

NUTRIENT/FERTILIZER REQUIREMENTS OF DIFFERENT VEGETABLES

Sr. No.	Name of Crops	Nutrients (kg/acre)			Bags/acre			Time and method of fertilizer application without compost	Time and Dose of fertilizer with Compost on P_2O_5 Basis IPNM (20:80)***
		N	P_2O_5	K_2O	Urea	DAP	SOP		
1.	**Bitter Guard**	45	40	25	1.50	1.75	1.00	1.75 bag DAP+1.0 bag SOP +0.50 bag urea at seed bed preparation; 0.50 bag urea at flowering; 0.50 bag urea after each third picking	Compost=530 kg, 1.4 bag DAP+0.70 bag SOP at seed bed preparation; 0.50 bag urea at flowering; 0.50 bag urea after each third picking

2	**Ghia Kaddu**	53	35	25	1.75	1.50	1.00	1.0 bag urea+1.5 bag DAP+ 1.0 bag SOP at seed bed preparation and 0.25 bag urea at initial growth, initial fruiting and after second picking	Compost=470 kg, 0.75 bag urea+1.25 bag DAP+ 0.75 bag SOP at seed bed preparation and 0.25 bag urea at initial growth, initial fruiting and after second picking
3	**Cucumber**	36	36	25	1.00	1.50	1.00	1.50 bag DAP+1.0 bag SOP at seed bed preparation; 0.50 bag urea at flowering and 0.5 bag urea after each picking	Compost=480 kg, 1.25 bag DAP+0.75 bag SOP at seed bed preparation; 0.25 bag urea at flowering and 0.5 bag urea after each picking
4	**Melon**	55	23	25	2.00	1.00	1.00	1.0 bag DAP+ 1.0 bag SOP at seed bed preparation; 1 bag urea at 5-6 leaves stage, 1 bag urea at flowering	Compost=300 kg, 0.8 bag DAP+ 0.8 bag SOP at seed bed preparation; 0.9 bag urea at 5-6 leaves stage, 1 bag urea at flowering
5	**Water Melon**	64	46	50	2.00	2.00	2.00	2 bag DAP+ 1.0 bag SOP at sowing; 2 bags urea+1bag SOP in two splits	Compost=610 kg, 1.6 bag DAP+ 0.6 bag SOP at sowing; 2 bags urea+1bag SOP in two splits
6	**Tinda**	60	35	25	2.50	1.50	1.00	1.5 bag DAP+1.0 bag SOP at sowing; 2.5 bag urea after fruit formation in three splits	Compost=470 kg, 1.25 bag DAP+0.75 bag SOP at sowing; 1.8 bags urea after fruit formation in three splits
7	**Baingan**	59	36	0	1.50	1.50	0	0.5 bag urea+1.5 bag DAP at sowing; 1 bag urea at earthing up. Add 0.5 bag urea after every 3-4 pickings	Compost=480 kg, 0.5 bag urea+1.25 bag DAP at sowing; 0.75 bag urea at earthing up. Add 0.5 bag urea after every 3-4 pickings
8	**Okra**	26	35	25	0.50	1.50	1.00	0.5 bag urea+1.5 bag DAP+1.0 bag SOP at sowing. Add 15-20 kg urea after 15 days	Compost=470 kg, 0.4 bag urea+1.25 bag DAP+0.75 bag SOP at sowing. Add 15-20 kg urea after 15 days
9	**Turmeric**	120	50	80	4.00	2.00	3.25	2.0 bag DAP+3.25 bag SOP+1 bag Urea at sowing; 1 bag urea each after 60, 90 and 120 days after sowing	Compost=670 kg, 1.75 bag DAP+2.75 bag SOP+1 bag Urea at sowing; 1 bag urea each after 60, 90 and 120 days after sowing

NUTRIENT/FERTILIZER REQUIREMENTS OF OIL SEED CROPS

Sr. No.	Name of Crops	Nutrients (kg/acre)			Bags/acre			Time and method of fertilizer application without compost	Time and Dose of fertilizer with Compost on P_2O_5 Basis IPNM (20:80)***
		N	P_2O_5	K_2O	Urea	DAP	SOP		

1.	**Super Raya, AARI Canola, Sarsoon DGL, Rohi Sarsoon**	35	30	12	1	1.25	0.5	0.50 bag urea+1.25 bag DAP+0.5 bag SOP at sowing; 0.5 bag urea at flowering	Compost=400 kg, 0.4 bag urea+1.0 bag DAP+0.25 bag SOP at sowing; 0.5 bag urea at flowering
2	**Toria**	23	23	12	0.75	1.00	0.5	0.50 bag urea+1.0 bag DAP+0.5 bag SOP at sowing; 0.25 bag urea at flowering	Compost=300 kg, 0.25 bag urea+0.80 bag DAP+0.3 bag SOP at sowing; 0.25 bag urea at flowering
3	**Taramira**	12	12	12	0.33	0.50	0.5	0.33 bag urea+0.50 bag DAP+0.50 bag SOP at sowing	Compost=160 kg, 0.25 bag urea+0.40 bag DAP+0.40 bag SOP at sowing
4	**Sandal Canola, PARC Canola hybrid, Super Canola, Other hybrids**	35	35	25	1.00	1.50	1.0	0.5 bag urea+1.5 bag DAP+1.0 bag SOP at sowing; 0.5 bag urea at flowering	Compost=470 kg, 0.25 bag urea+1.25 bag DAP+0.75 bag SOP at sowing; 0.5 bag urea at flowering
5	**Chakwal Raya, Chakwal Sarsoon**	34	23	12	1.00	1.00	0.5	0.50 bag urea+1.00 bag DAP+0.5 bag SOP at sowing; 0.5 bag urea at flowering	Compost=300 kg, 0.5 bag urea+0.8 bag DAP+0.3 bag SOP at sowing; 0.5 bag urea at flowering
6	**Linseed**	23	23	12	0.66	1.00	0.5	0.7 bag urea, 1.00 bag DAP, 0.5 bag SOP	Compost=300 kg, 0.5 bag urea, 0.80 bag DAP, 0.3 bag SOP

NUTRIENT / FERTILIZER REQUIREMENTS OF FRUIT PLANTS

Sr. No.	**Name of Crops**	**Nutrients (Kg / Plant)**			**Fertilizer Kg/Plant**			**Micronutrients (Grams / Plant) (Annual Dose)**	**Time and method of fertilizer application**
		N	**P_2O_5**	**K_2O**	**Urea**	**DAP**	**SOP**		

1.	**Citrus** (more than 10 years old)	1.00	0.50	0.50	1.74	1.10	1.00	Zinc Sulphate (33%)= 150 gram Ferrous Sulphate (20%)= 180 gram Borax = 50 gram	All P, micronutrients, 1/3 N and 1/2 K at pre blossom stage in end February; 1/3 in April, remaining 1/3 N and 1/2 K during last week of August.
2	**Mango** (about 15 years old)	2.00	3.00	2.00	2.40	2.20	1.50	Zinc Sulphate (33%)= 150 gram Copper Sulphate (24%)=75 gram Ferrous Sulphate (20%)= 250 gram Manganese Sulphate ()=150 gram Boric Acid (17%) = 50 gram	1.5 Kg N+3.0Kg P+1.0 Kg K after fruit harvest July/August; 0.5 Kg N+ Micronutrients in February/March, 1.0 Kg K+ Fruit development in April/May

FERTILIZER REQUIREMENTS OF DIFFERENT VEGETABLES (HIGH AND WALK IN TUNNEL FARMING)

Sr. No.	Name of crops	Time and method of fertilizer application (bags/acre)

1.	**Cucumber**	• At Sowing = Urea=0.5, DAP=2, SOP=1.0 • After 1/1.5 month, CAN=0.50, NP=0.75, SOP=0.50 • After 2 months of sowing, CAN=1.0, SOP=0.50 • Weekly during pickings, CAN=0.50, NP=0.50, SOP=0.50
2	**Tomato**	• At Transplanting, Urea=1.0, DAP=2.0, SOP=1.0 • After 1 month, Urea=0.5, SOP=0.50 • After 2 months, 2bag CAN+SOP=0.50 bag • After every 15 days, CAN=1.0, NP=1.0, SOP=0.50 bag
3	**Green Chilli / Shimla Mirch**	• At Transplanting Urea=1.0, DAP=2.0, SOP=1.0 • After 1 month Urea=0.50, SOP=0.50 • After 2 months 2bag CAN+SOP=0.50 bag • After every 15 days CAN=1.0, NP=1.0, SOP=0.50 bag

MICRONUTRIENTS RECOMMENDATIONS FOR TUNNEL CROPS (TOMATO, CUCUMBER, CHILLIES, SHIMLA MIRCH)

Sr No	Dose for alternate years (Kg/acre of tunnel covered area)
1	$ZnSO_4$. H_2O (33% Zn)= 6 kg/acre
2	$FeSO_4.7H_2O$ (20% Fe)=20 kg/acre
3	Borax (11% B) = 2.4 kg/acre
4	$CuSO_4.5H_2O$ (24% Cu) = 2.5 kg/acre

MICRONUTRIENT REQUIREMENTS OF SOME OF THE CROPS

Sr. No.	Name of Crops	Nutrients (Kg/acre)					Time and method of fertilizer application
		Zn	Cu	Fe	Mn	B	
1.	Rice	2.0	-	4.0	-	0.50	All the micronutrients are applied at sowing / transplanting
2	Wheat	2.0	-	4.0	4.0	0.50	
3	Cotton	2.0	2.0	-	-	0.50	
4	Maize	2.0	-	-	-	0.50	
5	Cucumber	2.0	-	-	-	-	
6	Tomato	2.0	-	-	-	0.50	
7	Potato	4.0	2.0	6.0	4.0	0.75	
Note: Micronutrient applications should be based on soil test basis. If micronutrient analysis is not available, follow the general recommendations for crops given above							

NUTRIENT CONTENTS IN FERTILIZER MATERIAL COMMONLY AVAILABLE IN PAKISTAN

Material	Minimum (%)		
	N	**P_2O_5**	**K_2O**
Diammonium Phosphate (DAP)	18	46	0
Triple Superphosphate (TSP)	0	46	0
Ammonium Sulphate	21	0	0
Ammonium Nitrate	26	0	0
Nitrophos	20	22	0
Urea	46	0	0
Potassium Chloride (MOP)	0	0	60
Potassium Sulphate (SOP)	0	0	50
Single superphosphate	0	18	0

MICRONUTRIENT CONTENTS IN FERTILIZER MATERIALS COMMONLY AVAILABLE IN PAKISTAN

Material	Minimum (%)
$ZnSO_4.7H_2O$	21% Zn
$ZnSO_4.H_2O$	33% Zn
$MnSO_4.4H_2O$	24% Mn
$CuSO_4.5H_2O$	25% Cu
$FeSO_4.7H_2O$	20% Fe
Borax ($Na_2B_4O_7.10H_2O$)	11% B
Boric Acid	17% B

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