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Problems and Prospects of Agriculture in Banagram Mouza, Burdwan, West Bengal

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Abstract

Land and soil is inseparable which are considered as important resources for mankind. The rural tracts of West Bengal are basically dominated by agricultural activity, where soil plays a vital role. Agricultural productivity is directly correlated to soil fertility which comprises inherent status of soil e.g. holding moisture; supplying minerals, nutrients and other imperative elements for the plant growth. Soil fertility can be amplified by external agricultural inputs like drainage, irrigation, fertilizer, implementation, scientific farming, ensuring the enhancement of soil productivity. As more than 80% of the male work force (as per Census of India, 2001) in Banagram mouza is directly or indirectly dependent on the primary activities, mainly agriculture, therefore only increased agricultural productivity can augment the rural economy profoundly. Therefore study of crops and their scientific management are considered to be broad societal concerns in present context, while the study of land use pattern carries the reflection of anthropogenic influence. The present work puts emphasis on productivity of crops and its association with agricultural inputs and soil fertility. Total agricultural operation from sowing to the selling of crops seems to be a great gamble in the mouza as sowing depends on the vagaries of monsoon and selling price depends on commission agents and mediators. Keeping all these in mind the following section also tries to address the major agricultural constraints faced by the cultivators.

Introduction

Soils are found where the atmosphere, hydrosphere, biosphere, pedosphere and lithosphere meet and interact with one another. It has been defined as "an independent, sub aerial evolutionary natural body on the earth surface, occurring at dynamic equilibrium with environment" (Dokuchaev, 1936). The four letter of the 'SOIL' stands for "Soul of Infinite Life" (Kanwar, 2000). Land resources, specifically fertile tracts of land in India being limited, the additional production will have to be achieved by increasing the productivity of land. That is possible by increasing the use of agricultural inputs viz., irrigation, quality seeds, fertilizers, pesticides, implements, credits and technology (Sadhu and Singh, 1991). Use of correct formulation of fertilizer mixture requires proper knowledge about the perfect mixture of a specific soil type and for a particular crop. Fertilizer mixtures in balanced form help in maintaining good physical health of soil (Sahi, 1997). Low and declining crop response to fertilizer in recent years can be attributed to continuous use of nitrogen (N) fertilizer alone or with inadequate phosphorous (P) and potassium (K), continued practice of intensive cropping with HYV seeds, inappropriate timing and method of fertilizer application, inadequate addition of organic manure, excessive irrigation and poor weed management etc. (Swaminathan,2007).

From agricultural point of view, soil fertility is understood by (i) nutrient requirement of plants, (ii) supply of nutrient in soil, (iii) way in which the nutrients are lost from soil and (iv) method through which soil fertility can be restored. Agricultural credit is a nucleus of the system of farm operation. Sadhu and Singh (1991) rightly quoted John D. Black "…we must provide credit first and foremost. This will enable them to buy more labour saving equipments, more seeds and fertilizers." The majority of peasantry needs programme for development and organization of the present status (Singh and Dhillon, 1984).

Objectives

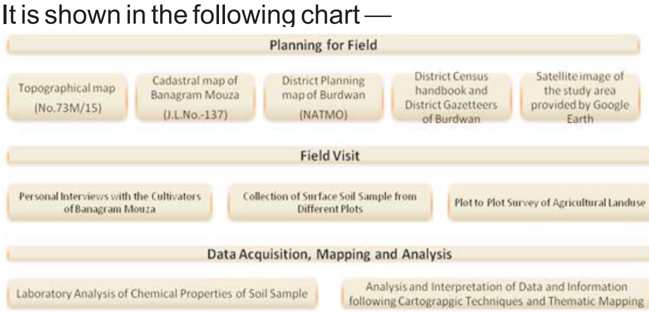
The prime objectives of the present research work on Problems and Prospects of Agriculture in Banagram Mouza, Burdwan-II, Burdwan are (i) identifying how agricultural inputs (i.e. irrigation, quality seeds, fertilizer, pesticides, implements, credit and technology) are influencing soil fertility vis-à-vis crop production and (ii) detecting the major problems of agricultural operation in present context and finding out feasible suggestions for the sustainable prosperity of the area.

The Study Area

The Banagram Mouza (J.L No. 137) corresponding to the Toposheet 73M/14 covers a geographical area of 52.67 hectares; it is located in C.D. Block Burdwan-II of Burdwan District in West Bengal. Geographically it is located between 23°15'40" N - 23°15'06" N latitude and 87°59'22" E - 87°59'45" E longitude (Fig.1).

Materials and Methods

It is shown in the following chart —



Results and Discussion

(1) Ownership of Land

On the basis of field investigation, it is observed that, 50% of the household possesses land between 1 to 3 hectares, 40% household occupies less than 1 hectare land and only 10% household have land above 3 hectares. This clearly depicts the poor socio-economic status of the residents of Banagram Mouza. This can be considered as one of the major obstacles of equitable development as majority of the households (say 90%) solely depends on agriculture where the share of land is < 3 hectares each (Fig.2).

(2)Crop Calendar

It is evident from the agricultural calendar (Fig.3) of Banagram Mouza, that there is a close relation between the pattern of cultivation i.e. cropping pattern and the prevailing climate. This can be illustrated by the following facts —

Aman is sown between July and mid of August i.e. during the onset of monsoon. During monsoon, it is left to be grown on the field and harvesting is done in the post monsoon period i.e. between December to the mid of January.

Boro is sown in-between mid of December to mid of January; and left to be grown on the field up to the end of March and generally harvested in April and May.

Potato is sown from November to the mid of December and some time up to the mid of February. It takes time to grow and is harvested at the last week of March.

(3)Cropping Pattern

From Fig. 4, it is clear that more than half of the agricultural land is multi-cropped i.e. cultivated more than once in a year. Considering the soil fertility status of the Mouza, this figure (57%) is not significantly high. The major reasons behind this picture as identified from the field investigation are as follows—

(i) Eastern, north-eastern and north-western part of the Mouza does not get sufficient irrigation water during *Rabi* (winter) season;

(ii) The cost of production of *Rabi* crops viz.- potato, boro paddy is much higher in comparison with the *Kharif* (rainy season) crops;

(Iii) The margin of profit for *Rabi* crops (say potato) varies greatly from year to year; therefore most of the marginal cultivators do not wish to take risk of loss.

(4)Farm Mechanization

Currently, agriculture depends mostly on the modern tools and techniques. The study area shows a modest development in terms of introducing latest implementation. It is evident from Fig.5.

More than 80% cultivator prepares their field by tractor whereas only 17% uses bullock for the same. About 77% of the peasant taking the help of agricultural labour to harvest; whereas 23% using harvester for harvesting.

As the study area is situated in a developing country, where intensive agriculture used to portray a picture of small and marginal holdings with intense population pressure, determining the pattern of land use in most cases, the use of machinery will have to be selective. The farmers are gradually adopting themselves with modern implements to negate the increasing labour cost. On the contrary, it is introducing a picture of decreasing marginal profit.

(5) Sources of Irrigation

A)Sub surface Sources

i) Shallow Well Irrigation: In the north-west and south-east part of the Mouza, there are three shallow wells which are dug and maintained by private individuals, although the government sometimes provides financial assistance for their construction. These wells are mostly operated with indigenous water-lifting devices.

ii) Pump Well Irrigation: Only two pumps are serving for the purpose of irrigation to north-western and north-eastern parts of the Mouza. These wells are operated by electricity and owned by private individuals.

iii) Canal Irrigation: About 3km away from the Mouza, a non-perennial canal flows from north-east to south-east direction which provides irrigation to the northern part of the Banagram Mouza (Map No.1).

B)Surface Sources of Irrigation

Natural source of irrigation in the study area includes mainly two sources i.e. pond water irrigation and rain fed irrigation (fig. 6).

Pond Water Irrigation: Pond water plays a significant role in irrigation for the study area. There are as many as 9 major ponds and *'Deghi'*s scattered all over the Mouza. The whole eastern part of the Mouza is under pond water irrigation. These ponds are filled up in the rainy season and help for irrigation in dry periods. These are also the points of ground water recharge; keeping the local water table high enough and help the Mouza to cope with the problem of water table declination during dry season.

Rain fed Irrigation: Cultivators are highly dependent on the monsoonal rainfalls as the existing sources of irrigation are not able to provide adequate irrigation to all parts of the Mouza equally. Extreme eastern and western parts of the Mouza have no such irrigation facilities at all; therefore cultivation of *Aman* paddy in this area entirely depends on the gamble of monsoon. In spite of having the facility of pump well, as the cost of water is quite expensive, most of the marginal farmers run their agricultural operations depending upon the monsoonal rainfall or pond water in *Kharif* season. With adequate and assured water supply available, the cropping pattern can be changed along the desired lines.

(6)Chemical Inputs

Because of low man-land ratio of the Mouza, which would gradually decrease in the coming years, apparently the only hopeful means to raise the productivity of the land is continuous and relevant use of fertilizers and pesticides. A field survey has been conducted to understand how sincerely the cultivators prefer a particular fertilizer over another and how conscious they are about the soil health. It is being clear from Figure.5, that 67% cultivators prefer a fertilizer by seeing advertisement through media exposure; while 23% of the farmers like to choose a fertilizer through field-method demonstrations; and only 10% of farmers are convinced through literature to select a fertilizer. Interestingly, not a single farmer has ever tested their land's soil character. In general, it seems that the lower the education level, the more a person is convinced by seeing commercial advertisements in media or demonstration effects from other farmers.

(7)Fertilizer Consumption

i) There is a variation in NPK consumption status for *Kharif* paddy and *Rabi* paddy; this is because of seasonal variation of climate. *Boro* paddy requires more NPK as the soils are much more exhausted and relatively dry compare to Kharif season

.ii) Potato is another soil exhausting crop which requires NPK ratio of about 9:7:7. Continuous implementation of NPK, for the production of rice and potato without examining the fertility status of soil, adds to the deterioration of soil health and adversely affects soil health and ruins the quality and quantity of crop production. Mustard and Sesame both being leguminous crop, require less NPK than paddy and potato; although these are minor crops, cultivated only in some pockets (Figure.6).

(8)Practices of Pesticide

Use of pesticides depends upon the types of diseases, attack of pest and weeds. Use of pesticides varies according to crop depending on its requirements. Major pesticides used for different crops by the cultivators of Banagram Mouza can be categorized as follows—

a) Pesticides used for paddy: Insecticides- *Oxamyl*, *Sevin*, *DDT*, *Lindan*e, *Fatara*, *Botafloro* etc Fungicides - *ziram*, *zineb*, *Monsoren* etc

b) Pesticides used for Potato:Insecticides- *Brankozef, Areton, Dithane M-45* etc

(9)Impact on Soil Health

a)Nitrogen Content of Soil (N)

Nitrogen is an essential nutrient for the production of rice. With the passage of time, paddy fields suffer from gradual diminishing of this element. Upon decomposition, the protein nitrogen changes to ammonium and then to nitrate nitrogen.

Organic N ------> NH_4 (Anaerobic Zone)
No_3 ------> $N_2 + N_2O$ (Anaerobic Zone)

i) Ammonical Nitrogen Status (NH_4)

The soil of Banagram Mouza is deficient in Ammonical Nitrogen (NH3-N) content; have an ammonium and amide forms of nitrogen content of 14.56kg/hectare, which is considered as low. Generally this form of nitrogen fertilizers are not applied as topdressing on rice; and this might be responsible for low Ammonical Nitrogen content of the soil in the Mouza

ii) Nitrate Nitrogen Status (NO_3)

Most parts of the Mouza, except the peripheral parts, have a high content (50.44kg/hectare) of Nitrate Nitrogen. Extreme northern, southern and eastern parts of the Mouza have a medium Nitrate Nitrogen content of 20.17kg/hectare (fig.9). Nitrate form of nitrogen fertilizers are usually applied as topdressing. All the areas having a high content of Nitrate Nitrogen are under potato cultivation; whereas all those lands which are under other than potato cultivation have a medium content of Nitrate Nitrogen. As lots of Nitrate forms of nitrogen fertilizers are applied in potato field, therefore these lands are enriched with high Nitrate Nitrogen content. So there is a close relationship between soil properties and crop practices.

iii)Phosphorous Content

Phosphorous is another essential nutrient for rice which plays an important role in metabolic exchange. When phosphorous fertilizers are applied to a soil, the average amount absorbed by plants is only 20-30% of that applied; since phosphorous is an anion and soils have very little anion exchange capacity (Arkery and Donahue, 1984). Phosphorous content in soils ranges from 22.42kg to 72.86kg/hectare (Fig. 10). The regional variation of the distribution of phosphorous in the soil is quite high. In the north-western part of the Mouza, most soils have phosphorous content more than 72.86kg/hectare (High); whereas in the soils of southern part of the Mouza, the level of concentration ranges from 22.42 to 54.57kg of phosphate per hectare (Medium). Phosphate content in the soils of rest of the Mouza ranges from 54.57 to 72.86kg/hectare (Medium-High).

iv)Potassium Content

Potassium is a beneficial element for crop. Potassium content in the soil of the Mouza falls within a range of 112.21 to 392.39kg/hectare (Fig. 11). In the central part of the Mouza, potassium content falls within 112.21 to 280.28kg/hectare (Medium); soils of northern, eastern and southern parts of the Mouza are low in potassium content (112.21kg/hectare). A very small pocket in the eastern part of the Mouza is high in potassium content (280.28 to 392.39kg/hectare).

v)Organic Carbon Content

Organic Carbon determines the water holding capacity of the soil along with surface run-off and mulching. Farmyard manure, composts, green manure, leguminous crops are good sources for replenishing organic matter for rice. Organic Carbon content of Banagram Mouza ranges from 0.5 to 0.75% (Medium) in most parts (Fig. 12). Only a very small pocket in north-western part shows organic carbon content above 0.75% (High); small areas of northern, eastern and southern parts have organic carbon content of less than 0.5% (Low).Continuous practice of soil exhausting crops, less use of farmyard manure and absence of crop rotation can be attributed as major factors controlling the organic carbon (matter) content of soil in the Mouza.

vi)pH Status

Availability of nitrogen and phosphorous is indicated by the soil pH. Generally nitrification is higher where the pH ranges within 6.5-7.5; pH of the Banagram Mouza ranges from slightly acidic (6.5) to Neutral (7.0). Central part of the Mouza has a pH between 6 and 6.5; eastern, northern, southern and south-eastern parts of Mouza, have a pH value ranges from 6.5 to 7 (Fig. 13).Major factors determining the pH of the soil are as follows—

i) Unprecedented use of fertilizers is a major determining factor of pH in the Mouza. Acid fertilizers like Ammonium Sulphate $(NH_4)_2SO_4$ make the soil acidic; as most of the agricultural field in the central part of the Mouza are mainly dominated by potato cultivation in *Rabi* season and *Aman* paddy during *Kharif* season, therefore continuous use of acidic fertilizers make the soil acidic.

ii) Irrigation might have a role here to play in determining the pH content of soil. Generally, the pH value tends to drop as the soil becomes progressively dry; most part having pH values within 6.5 to 7 are the lands facing a scarcity of irrigation water in *Rabi* season.

(10)Temporal Variations in Crop Production

Amount of production in the study area has revealed a sign of fluctuation over time **(**Fig. 14**)**

i)Production of Paddy

*a) Kharif Paddy (Aman):*Production of *Aman* has increased in year 2012 in comparison with the production of 2007. About 23% cultivators in 2012 produced more than 900kg of rice per bigha. Good rainfall and high doses of fertilizers, pesticides may be the probable reason behind it.

*b) Rabi Paddy (Boro):*Production has shown a decreasing trend in 2012 in comparison to 2007. Percentage of cultivators having average production of 720kg per bigha have increased to 37% in 2012 over 30% in 2007; and 53% cultivators now have an average production between 720-900kg per bigha (Figure.9).

ii)Production of Potato

Potato production has decreased considerably in 2012 than that of 2007 in the Mouza (Fig. 15). Now 30% of the potato growers have an average production of 3250-4000kg per bigha; whereas in 2007 this figure was only 17%. In 2007 20% of the cultivators used to have an average production of more than 4000kg per bigha (Figure.9). Potato requires a steady long and dry cold season for its growth. Sporadic rainfall during the late growing period, early blight and cut worms caused damage in the production in 2012 (* 1 bigha = 1/3 acre or 0.1338 hectare).

Perception Analysis on Agricultural Amenities

It has been clear from perception analysis (Figure.10), based on the field investigation that the major problems affecting crop production in the study area are as follows (Fig. 16)—

i) *Lack of irrigation water, particularly in dry season:* About 73% of the respondents are unsatisfied with the supply of irrigation water. Fluctuation in canal discharge is major problem in this regard.

ii) Remunerative selling prices of crops: About 70% peasants are very much unsatisfied with the current selling price of crops. Huge fluctuation in potato price from year to year turns out to be a gamble to the potato cultivators.

iii) About 44% are utterly unsatisfied with the existing *credit system and warehouse facilities*. At present, storage facility is available only for potato.

iv) Dependency on money lenders, middle-men, commission agents and brokers (*dalals)* for credit and *selling of crops*.

iii)Margin of Profit: In general, the margin of profit more or less tends to decrease in 2012 over 2007. There is no such positive growth in terms of profit for any of three major crops. The following conclusions can be made from Fig.17 and 18, that—
(i) In case of rice (both *Aman* and *Boro*), although the production has marginally increased in 2012; but the peasants have received a much lower selling price than deserved. Apart from that, cost of all the agricultural amenities (viz. chemical inputs, price of seed, irrigation water, labour etc) have increased considerably over the years.
(ii) In case of potato, the selling price of potato is just a gamble to the peasants. For example, in 2007 they got Rs.260 to 300 per bag of 50kg; when the demand was significantly high. One also has to keep in mind, that production of potato in the Mouza in 2007 was also much higher than that of 2012. But in 2012 for a bag of 50kg, they got only around Rs.130 to 160. One of the major factors affecting the remunerative selling price of crops both paddy as well as potato is complete dependence on middle-man, commission agents and brokers (*dalals)* for the selling of crops.

Suggestions and Recommendations

1) Recommended Doses of Fertilizers Inputs

On the basis of the present analysis, it can be summarised that the soils of the Banagram Mouza are generally deficient in Ammonical Nitrogen content; although Nitrate nitrogen content is significantly higher than the Ammonical Nitrogen. If we look at the major diseases that are affecting crop production are mostly caused by the excess nitrate nitrogen content in the soil. Phosphate and Potassium content can be said to be just sufficient except for a few small pockets. To compensate the deficiency of Ammonical Nitrogen and to avoid the diseases caused by over usage of nitrate form of fertilizers, the recommended doses for application of fertilizers are given below (Table - 3).

2) Use of Organic Manure

Organic matter content in the study area is very low; thus it needs some special care in order to improve nutrient holding capacity as well as infiltration of water. It also helps to break down the pesticides more quickly. The following steps will help to increase the organic matter content in agricultural field; viz.
(I) Addition of 1 to 2 inch layer of crop residues, farmyard manure, and domestic bio-degradable waste should be used in the field before sowing.
ii) Instead of cultivating soil exhausting crops such as Rice and Potato in the same year, cereals or leguminous crop can be practiced in between *Aman* and *Boro* season to rejuvenate soil health.
iii) Tillage is another major practice that reduces the organic matter level; therefore use of bio-fertilizer should be increased to maintain the organic matter.

Conclusion

There is an immense prospect to boost production as the area has extremely rich and fertile tract of land, blessed with high surface and sub surface underground water potential. Apart from the aforesaid suggestions, a few governmental initiatives are essential to meet the basic requirements of the cultivators. Firstly,. *Provision of irrigation facilities* by extending it right up to the field through construction and lining of field channels and field drains. Secondly, *Provision of Agricultural Credit* through various short-term and long-term loans depending upon the requirements of the cultivators at affordable rates of interest. Thirdly, *Provision of Agricultural Marketing* to ensure remunerative selling price and to narrow down the unwanted exorbitant price gap between the producer and the consumer. Apart from these factors, incentives such as enhanced procurement price, proper warehousing or storage facilities, free training programmes, timely demonstrations and generalized crop insurance scheme can play a healthy role in increasing sustainable farm productivity in the Mouza.

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Table – 1 : Water Requirements by Rice and Potato

Crops	Growing Season (days)	Total water requirements (area inches)	Daily water requirements (area inches)
Rice	98	41.7	0.43
Potato	88	26.7	0.31

Source:- The ICAR Hand Book,1990

Table – 2: Half-lives of Pesticides in Soils

Types of Pesticides	Approximate half-lives (years)
Lead, arsenic, copper, mercury compounds-	10-30
Dieldrin, BHC, DDT insecticides-	2-4
Triazine herbicides-	1-2
Benzoic acid herbicides-	0.2-1
Urea herbicides-	0.3-0.8
2,4-D and 2,4,5-T herbicides-	0.1-0.4
Organophosphate insecticides-	0.02-0.2
Carbamate insecticides-	0.02-0.1

Source:- Metcalf,1971

Table – 3: Recommended Doses of Fertilizer Inputs (Banagram Mouza)

Fertilizer	Average in Soil of The Mouza (kg/hectare)	Recommendation (Kg/hectare		
		Paddy		Potato
		Aman	Boro	
Nitrogen (N)	350	45.0	87.5	225
Phosphate (P)	48	42.5	78.0	200
Potassium (K)	252	60.0	72.0	210

**As recommended by Directorate of Agriculture (Govt. of W.B), Burdwan;(May,2013)*

Table – 4 : Optimum pH Level for Rice and Paddy

Crops	Optimum pH range
Rice	4.0-6.0
Potato	5.0-5.5

Source:- Acid Soils of India and Limit, ICAR,51:81,1975

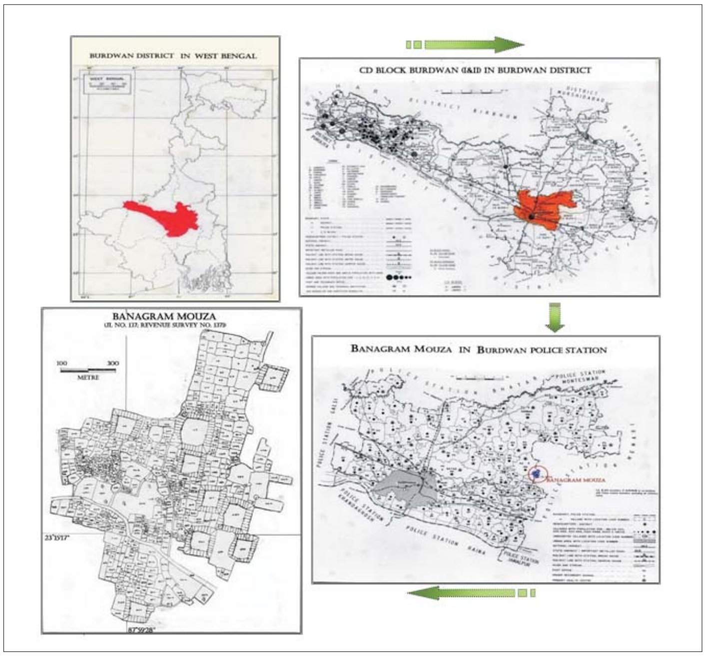

Fig. 1: Location of Banagram Mouza, Burdwan

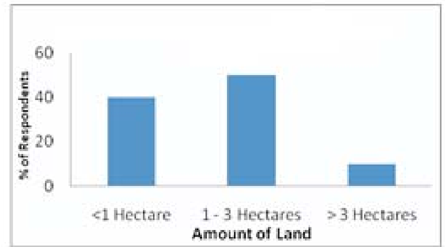

Fig. 2: Status of Land Ownership of the Study Area

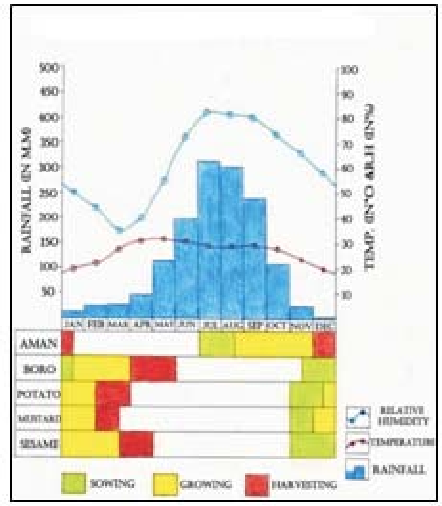

Fig. 3: Crop Calender of the Study Area

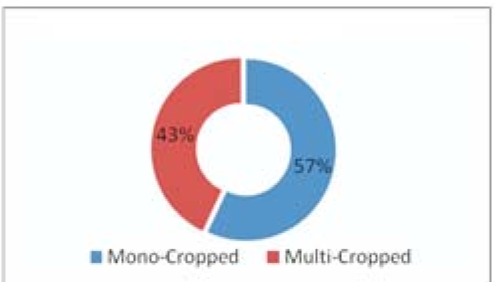

Fig. 4: Cropping Pattern of the Study Area

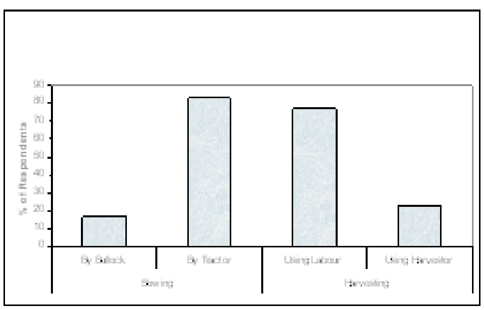

Fig. 5: Nature of Farm Mechanisationin the Study Area

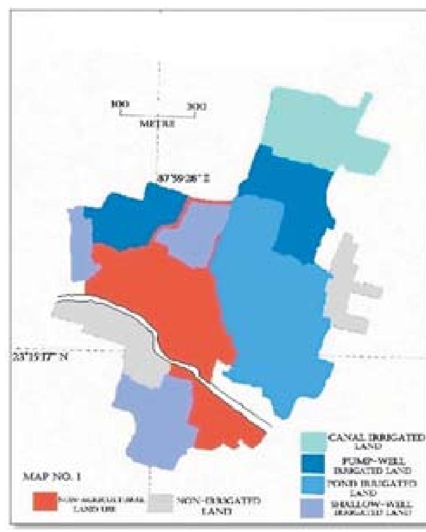

Fig. 6: Area under Different Modes of Irrigation

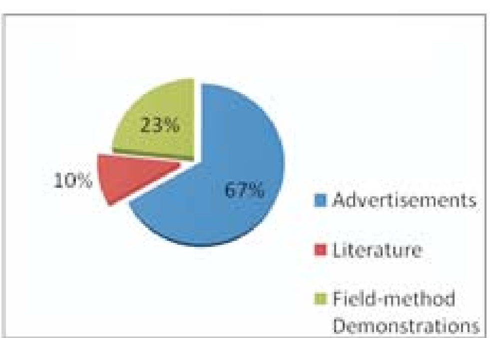

Fig. 7: Sources of Information for Fertilizer Usage

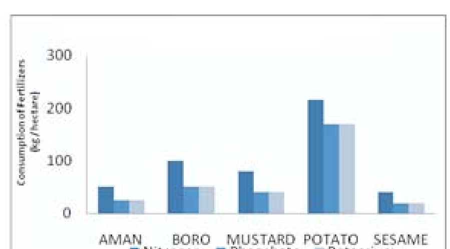

Fig. 8: Pattern of Fertilizer Usage in the Study Area

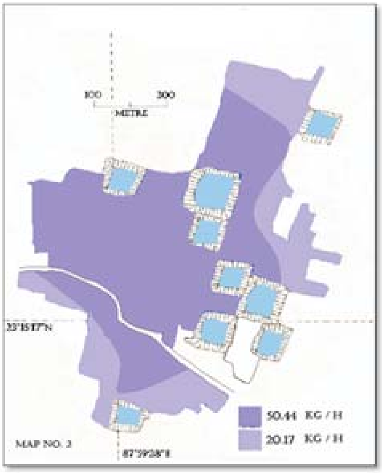

Fig. 9: Soil Nitrogen Status in the Study Area

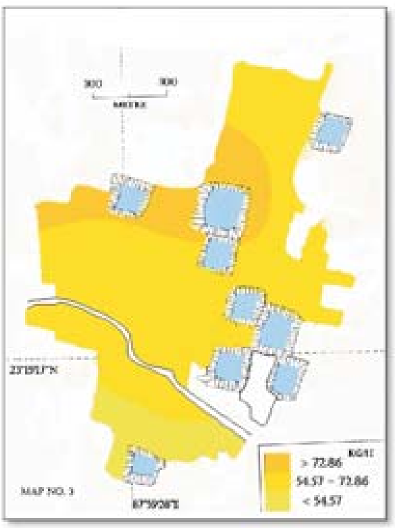

Fig. 10: Soil Phosphorous Status in the Study Area

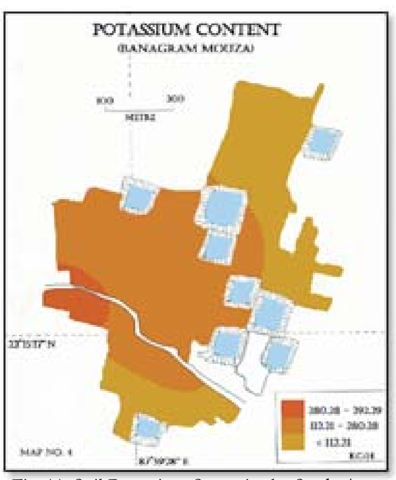

Fig. 11: Soil Potassium Status in the Study Area

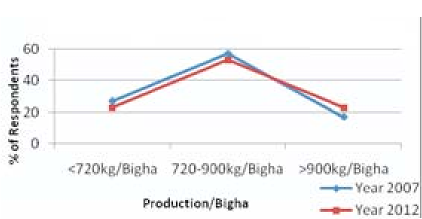

Fig. 14: Temporal Variation of Aman Paddy Production

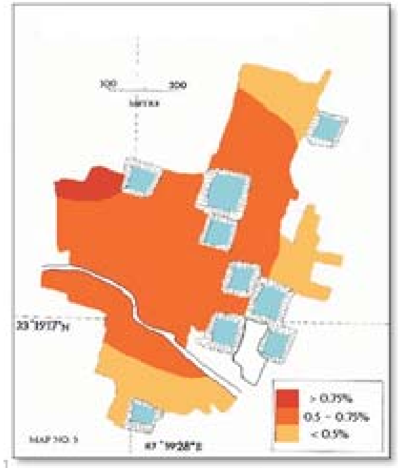

Fig. 12: Soil Organic Carbon Status in the Study Area

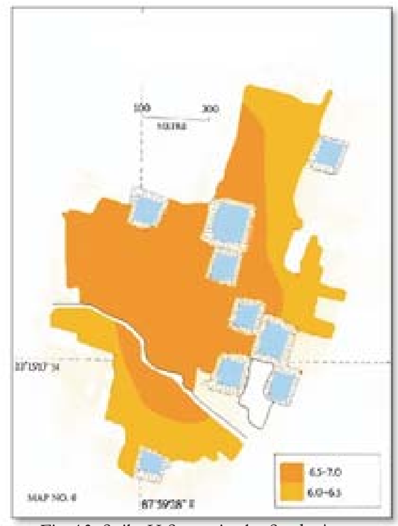

Fig. 13: Soil pH Status in the Study Area

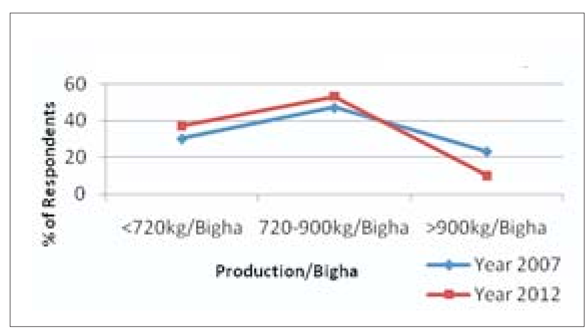

Fig. 15: Temporal Variation of Potato Production

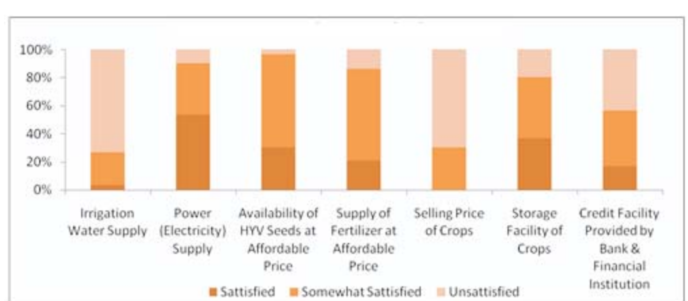

Fig. 14: Temporal Variation of Aman Paddy Production

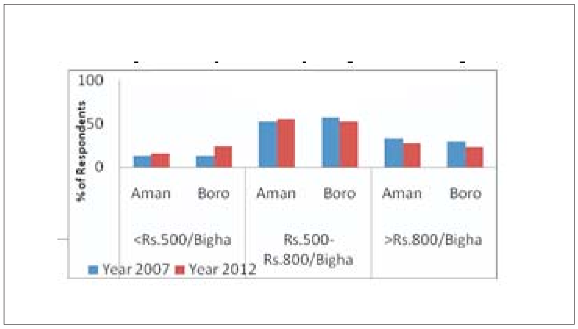

Fig. 17: Profit Margin in Paddy Cultivation

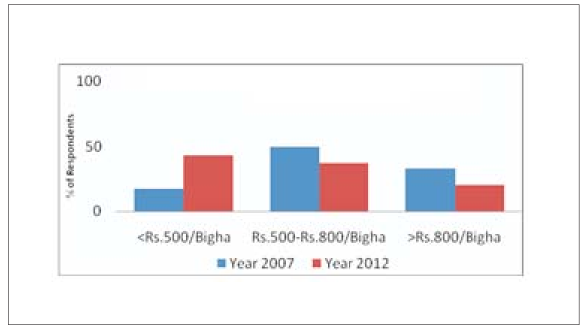

Fig. 18: Profit Margin in Potato Cultivation

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