ISSN : 1812-5379 (Print)
ISSN : 1812-5417 (Online)
http://ansijournals.com/ja

JOURNAL OF AGRONOMY

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Journal of Agronomy 3 (1): 52-58, 2004
ISSN 1680-8207
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Quantitative Assessment of Social and Some Input Variables Relating to Rice Production in Dera Ismail Khan, Pakistan

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Abstract: A survey was conducted from 50 randomly selected rice growers from 25 villages of Dera Ismail Khan, NWFP, Pakistan. The survey report revealed that 96 percent rice growers planted well-adapted high yielding coarse rice variety IR-6. All the farmers followed recommendations regarding land preparation using tractor and tractor-mounted implements. Half of the population used their self-produced seed, which was kept under profaned conditions. Majority of the farmers raised rice nursery during the month of April to mainly escape from the attack of rice stem borer. More than half (56%) used optimal age (30-40-days-old) rice nursery. Almost all the population (96%) used transplanting method but none of them used the line method of transplantation. Although, a big fraction (36%) of the sampled population was illiterate, yet all were applying recommended doses of fertilizers. Similarly, most of the growers (70%) were impelled to apply canal water at 4-8 days interval according to the water schedule given by the Revenue department. Majority of the population reported weeds and pest (stem borer) in rice crop. The per hectare rice yield of the farmers interviewed, although, exceeds the national average rice yield but none of the growers could fully exploit the potential yield of the cultivar. The frequency of the sampled population for getting information from nearby growers was very high mainly due to uncertain and insufficient knowledge provided by the other sources. Fifty-four percent of the farmers needed loan for the purchase of fertilizers, insecticides etc for rice crop and thirty-two percent declared banks as the suitable source of credit. Water shortage, high costs of inputs, non-availability of skilled labour during peak planting season, sub-optimal plant population, weeds and pest infestation, high dependence of knowledge on nearby growers and low price of rice in the local market were the major restrictions in higher yields of rice in Dera Ismail Khan, NWFP, Pakistan.

Key words: Rice, *Oryza sativa*, farmers, socio-economic conditions, Pakistan

INTRODUCTION

Dera Ismail Khan is the extreme south district of North West Frontier Province (NWFP) of Pakistan and lies in between 31°49′ N latitude and 70°55′ East longitude. It has a total geographical area of 0.890 million hectares, out of which only 0.308 million hectares are under cultivation (18.31% is under crops whereas 15.53% is not available for cultivation). Total irrigated area of Dera Ismail Khan is about 14.73%. The district had a population of 853 thousand (116.4 persons per square Kilometer) in 1998 with an annual growth rate of 3.26%. Despite certain local variability, the area is comprised of four basic divisions viz. mountains, a series of steeply sloping alluvial fans, the "Daman" imperceptibly slopping piedmonts, and the "Kacha" the flood plains of the Indus river. The soils of the area are calcareous in nature, deficient in organic matter, nitrogen and phosphorus and adequate to marginal in potassium. The climate is arid to semi-arid. It is hot and dry in summer with moderate spells during monsoon season. The elevation ranges from 400 to 4000 feet above sea level. The mean maximum temperature in summer and mean minimum temperature in winter is 45 and 8°C, respectively. The mean annual precipitation ranges from 150-250 mm and relative humidity varies from 51% in June to 78% in October.

Rice (*Oryza sativa* L.), like in many other parts of the country, is the major summer crop of the area. Out of total cultivated area (0.308 million hectares) of Dera Ismail Khan, rice is sown on 6044 hectares with total production and average yield of 16366 tones and 2707 kg ha^{-1}, respectively[1]. The per hectare rice yield in this part of the country, although, exceeds the national average rice yield of 1836 kg ha^{-1} [2], the growers are not exploiting the

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potential rice yield upto the mark. Genetic potential, proper land preparation, judicious use of fertilizers, use of high quality seed, timely cultural operations and plant protection measures are the components, which determine the yield of a crop. The application of these yield-contributing factors and implementation of new developmental techniques could only be realized by knowing the socio-economic status of the farmers. The productivity cannot move ahead unless the farmer is sound both financially and technically and confident of the earnings of the product to be produced. In this context, such types of survey reports provide first-hand information about the resources and problems of farming community and eventually help in designing effective persuasive technologies for an area.

Keeping in view the importance of the subject, a survey was undertaken in the rice growing areas of Dera Ismail Khan to asses the socio-economic status of the farmers, role of economic institutions in providing credit facilities and role of agricultural extension in educating rice growers of the area.

MATERIALS AND METHODS

Present endeavor was conducted by a survey research. A total of 50 farmers were interviewed from 25 villages of Dera Ismail Khan. Simple random sampling technique of the probability sampling was adopted. The respondents were selected on the basis of their acreage under rice cultivation. Farmers having 5 acres or more under rice cultivation were included in the final interview schedule. The wealth of the information obtained from interviews was compiled. Frequencies and percentages were calculated and tabulated across respondents for comparison.

Limitation of the study: The researcher has faced difficulty in conveying a number of questions dealing with the information access, extension services and credit. The researcher came to know that only the respondents who were illiterate were unable to understand the format of the questions. It is, therefore, suggested to concentrate on the format of the questions and attention should be paid in how to phrase and ask such type of questions in future investigations of the same kind. This will certainly improve response rate and drawn of valid conclusions.

RESULTS AND DISCUSSION

A. Input variables

Area under rice and source of irrigation: The area under rice crop varied from 5 to 40 acres. Twenty-five (50%) farmers had 5 to 10 acres, 16 (32%) had 10 to 20 acres, 5 (10%) had 20 to 30 acres while only 4 (8%) had 30 to 40 acres area under rice crop. Similarly, 6 (12%) farmers of the surveyed area used tube-well irrigation, 31 (62%) canal water irrigation while; the remaining population 13 (26%) used both sources of irrigation viz. Canal and tube-well (Table 1).

Land preparation: All the sampled population prepared their land using tractor and tractor-mounted implements (Table 1). Out of the sampled farmers, 8 (16%) growers performed one ploughing with cultivator and planking, 18 (36%) performed one deep ploughing followed by cultivator and leveling, 10 (20%) performed one deep ploughing followed by two cultivators and leveling and 14 (28%) performed two deep ploughings followed by two cultivators and leveling with land leveler. It is obvious from the survey that the above mentioned land preparation practices adopted by the farmers were based on their financial status, nature of the soil and previous crop sown.

Planting rice varieties: Forty-eight (96%) rice growers of the sampled area planted well-adapted high yielding coarse rice variety IR-6 (Table 2). This variety constituted 46% of the total rice export of Pakistan[2]. Only 2 (4%) growers of the sampled area cultivated another coarse rice variety KSK-282. The population cultivating IR-6 put forth reasons, which are given in Table 2.

Aromatic varieties: None of the interviewed farmer has cultivated fine rice varieties. The main reason for not using these varieties for cultivation was their unsuitability under the local ecology (40%), followed by their susceptibility to insect pest (Table 3).

Source of seed: Good quality seed is the key component of crop production. Out of total 50 farmers interviewed, 13 (26%) took seed from the local market, 25 (50%) used their self-produced seed, 9 (18%) took seed from neighboring farmers and only 2 (4%) of the farming community

Table 1: Source of irrigation and land preparation in sampled area

Irrigation			Land preparation		
Source	Frequency	%age	Ploughing	Frequency	%age
Tube-well	6	12	1	8	16
Canal	31	62	2	18	36
Both	13	26	3	10	20
			4	14	28

Table 2: Rice variety under cultivation in sampled area

Reason	Frequency	%age
High yielding variety	36	72
Best suited under local ecology	3	6
Resistant to diseases	2	4
Recommended variety	1	2
Seed easily available	1	2
Reason not known	5	10

Table 3: Reasons for not cultivating basmati varieties in sampled area

Reason	Frequency	%age
Not suited under local ecology	20	40
Susceptible to insets/pest	12	24
Lack of awareness	1	2
Low yielding	8	16
Late maturing	4	8
Reason not known	5	10

obtained seed from Agriculture department (Table 4). There was a high dependence on self-produced seed, which was not cleaned, stored and processed according to standard procedures.

Time of nursery sowing: There were only 4 (8%) farmers who raised rice nursery in May. The rest of 46 farmers (92%) were sowing rice nursery in April (Table 4). Under Section 4(a) of the Pakistan Agricultural Pest Rules 1960, no one can sow rice nurseries earlier than May 10 in Sindh and May 20 in Punjab province. Similarly, transplanting is confined to end of July in Sindh and not earlier than August 7 in Punjab[3]. The main reason for not following this recommended planting schedule is because of high pest infestation in late sown crop and cost of insecticides as well.

Age of rice nursery: Twenty-eight farmers (56%) used optimal age (30-40 days old) rice nursery, 14 (28%) 40-50 days old nursery and 8 (16%) 50-60 days old rice nursery (Table 5). Above-optimal rice seedlings cannot withstand transplanting shock, produce lesser number of tillers and ultimately low yield.

Causes of late transplanting: Twenty-two (44%) farmers used above-optimal age rice nursery (Table 5). Among these, 8 (16%) farmers did late transplanting due to water shortage, 4 (8%) due to labour shortage and 10 (20%) farmers due to the presence of other crop(s) in the field.

Planting technique: Transplanting was the most popular method in the sampled area. Among the farmers interviewed, 47 (96%) used transplanting method. The frequency of farmers adopting broadcast method was only 3 (6%). High yield, local acceptability, good plant stand and low weed flora were the reasons for exercising transplanting technique (Table 6).

Fertilizer use: The farmers interviewed were aware and applied recommended dose of fertilizers (Table 6). However, the dose of fertilizers varied from 50-125 kg ha^{-1} in case of Urea and 50-75 kg ha^{-1} in case of Diammonium Phosphate (DAP). The fraction of the population using Urea @ 50-75 kg, 75-100 kg and 100-125 kg ha^{-1} was 11 (22%), 35 (70%) and 4 (8%), respectively. Similarly, farmers using DAP @ 50 kg ha^{-1} were 41 (82%) and 50-75 kg ha^{-1} were 9 (18%), respectively.

Transplantation: None of the sampled population used the line method of transplantation (Table 7). This was because of the scarcity of technical labour during planting season. Casual labour was hired for rice transplanting that maintained unequal plant spacing, which resulted in the sub-optimal plant population and eventually low yield.

Irrigation interval: The link between water and rice is crucial. It takes more than 2,000 tones of water to grow one tone of rice[4]. A large number of rice growers, 44 (88%) were wholly or partially dependant on canal water irrigation (Table 7). Under this system, every farmer is restricted to irrigate his field according to the schedule given by the Irrigation department. Among the population, 7 (14%) irrigated rice crop as and when it needed. While, 8 farmers (16%) applied irrigation with 1-4 days interval and the rest of community i.e. 35 (70%) was applying with 4-8 days interval according to the timetable given by the Irrigation department.

Weeds and weeding: Counce *et al.*[6] reported that rice research field plots are likely to have nearly complete weed control whereas normal farmer field-grown rice often have considerably greater weed populations. In Pakistan, rice yield is reduced upto 60% due to high weed infestation[5]. Thirty-one farmers (62%) of the sampled population reported weeds in rice crop. Among these, 9 (18%) reported Jangle rice (*Echinochloa colonum*), 9 (18%) observed Purple nut sedge (*Cyperus rotundus*), 6 (12%) identified both weeds while 7 (14%) were aware about weeds but did not know name of weeds. As regards weed control, 13 (26%) used weedicides, 12 (24%) rely on hand weeding while the remaining 6 (12%) used no weed control measures (Table 8).

Plant protection: Rice stem borer is the main pest, which reduced rice yield upto 90% due to heavy infestation in Pakistan[3]. Among the sampled population interviewed, 33 (66%) identified this pest in their crop. While, rest of the farmers, 17 (34%) were aware of insects' attack but did not know name of the pest damaging their crop. Thirty-two

Table 4: Source of seed and time of nursery sowing in sampled area

Seed			Time of nursery sowing		
Source	Frequency	%age	Month	Frequency	%age
Market	13	26	April	46	92
Own seed	25	50	May	4	8
Growers	9	18	-	-	-
Agriculture Department	2	4	-	-	-

Table 5: Age of nursery and causes of late transplanting in sampled area

Age of nursery (days)			Late transplanting		
Age	Frequency	%age	Reason	Frequency	%age
30-40	28	56	Water shortage	8	16%
40-50	14	28	Scarcity of labour	4	8%
50-60	8	16	Land occupied by other crops	10	20%

Table 6: Rice planting technique and fertilizer use in sampled area

Planting technique (Transplanting)			Fertilizer use kg ha^{-1}		
Reason	Frequency	%age	Urea	Frequency	%age
High yielding method	26	52	50-75	11	22
Traditional method	11	22	75-100	35	70
Good plant stand	2	4	100-125	4	8
Low weed flora	2	4	50 DAP	41	82
Un-known reason	6	12	50-75	9	18

Table 7: Transplantation and irrigation interval in sampled area

Transplantation			Irrigation interval		
Methods	Frequency	%age	Interval	Frequency	%age
Line sowing	0	0	As required by the crop	7	14
Irregular	50	100	1-4 days	8	16
			4-8 days	35	70

Table 8: Weeds, pest and their control measures in sampled area

Weeds			Weed control techniques		
Weeds	Frequency	%age	Control	Frequency	%age
Nut sedge	9	18	Weedicide	13	26
Jangle rice	9	18	Hand weeding	12	24
Both	6	12	No control	6	12
Pest			Pest control measures		
Pest	Frequency	%age	Insecticide	Frequency	%age
Rice stem borer	50	100	Furadon	32	64
-	-	-	Any granular	18	36

Table 9: Paddy yield and farmer's perception of yield constraints in sampled area

Yield kg ha^{-1}			Causes of low yield		
Yield	Frequency	%age	Causes	Frequency	%age
2160-3360	24	48	Water shortage	8	16
3360-4560	14	28	High cost of inputs	23	46
Not mentioned	12	24			

Table 10: Education level of the farmers in sampled area

Education level	Frequency	%age
Primary education	8	16
Matric	5	10
Intermediate	11	22
Graduation	4	8
Post-graduation	4	8
Illiterate	18	36

(64%) growers used Furadon (G) for the control of rice stem borer. Eighteen (36%) used any granular insecticide available in the local market (Table 8).

Paddy yield kg ha^{-1}: The paddy yield varied from 2160-4560 kg ha^{-1} depending upon the availability of resources, management of crop and socio-economic status of the growers. Twenty-four (48%) of the interviewed population was producing rice yield from 2160-3360 kg ha^{-1} and 14 (28%) farmers from 3360-4560 kg ha^{-1}. Twelve (24%) farmers were reluctant to disclose their paddy yield and presuming the interviewer as the staff of Land Revenue department who could impose heavy taxes on their produce (Table 9).

Table 11: Sources of information of rice growers in sampled area

	To high extent		Average extent		Little extent		Not at all	
Source	Frequency	%age	Frequency	%age	Frequency	%age	Frequency	%age
Nearby farmer	13	26	1	2	6	12	4	8
Agricultural Research	5	10	1	2	8	16	10	20
Agricultural Extension	1	2	0	0	8	16	7	14
Radio	1	2	1	2	14	28	3	6
TV	0	0	1	2	10	20	4	8
Newspaper	0	0	0	0	7	14	8	16
Pamphlets	0	0	0	0	10	20	6	12

Table 12: Favourite source of information of rice growers in sampled area

	Very much		Much		Some		None	
Source	Frequency	%age	Frequency	%age	Frequency	%age	Frequency	%age
Nearby farmer	5	10	8	16	7	14	2	4
Agricultural Research	18	36	3	6	1	2	1	2
Agricultural Extension	10	20	4	8	2	4	2	4
Radio	2	4	3	6	9	18	1	2
TV	4	8	2	4	9	18	2	4
Newspaper	0	0	1	2	9	18	6	12
Pamphlets	3	6	0	0	9	18	4	8

Table 13: Effective source of information for rice crop in sampled area

	Very effective		Effective		Less effective		Ineffective	
Source	Frequency	%age	Frequency	%age	Frequency	%age	Frequency	%age
Nearby farmer	16	32	4	8	2	4	2	4
Agricultural Research	9	18	7	14	5	10	3	6
Agricultural Extension	4	8	5	10	5	10	4	8
Radio	4	8	4	8	10	20	1	2
TV	4	8	2	4	6	12	2	4
Newspaper	1	2	2	4	12	24	3	6
Pamphlets	4	8	2	4	10	20	3	6

Table 14: Role of information sources for transfer of technology in sampled area

	Very positive		Positive		Less positive		Negative	
Source	Frequency	%age	Frequency	%age	Frequency	%age	Frequency	%age
Nearby farmer	17	34	6	12	0	0	1	2
Agricultural Research	6	12	2	4	0	0	12	24
Agricultural Extension	2	4	2	4	2	4	10	20
Radio	2	4	3	6	9	18	3	6
TV	2	4	0	0	9	18	3	6
Newspaper	1	2	1	2	8	16	6	12
Pamphlets	4	8	0	0	6	12	3	6

Table 15: Channels used by extension workers for dissemination of technology in sampled area

	Mostly		Occasionally		Rarely		Never	
Channel	Frequency	%age	Frequency	%age	Frequency	%age	Frequency	%age
Farm visits	2	4	13	26	4	8	10	20
Exhibitions	0	0	5	10	4	8	5	10
Field days	1	2	2	4	5	10	10	20
Demonstrations	1	2	8	16	6	12	3	6

Table 16: Effective channels used by extension workers for dissemination of technology in sampled area

	Very effective		Effective		Less effective		Ineffective	
Channel	Frequency	%age	Frequency	%age	Frequency	%age	Frequency	%age
Farm visits	19	38	2	4	0	0	0	0
Exhibitions	9	18	5	10	0	0	0	0
Field days	14	28	3	6	1	2	0	0
Demonstrations	17	34	7	14	0	0	0	0

Table 17: Suitable source of credit for rice growers in sampled area

	Very suitable		Suitable		Less suitable		Unsuitable	
Source	Frequency	%age	Frequency	%age	Frequency	%age	Frequency	%age
Bank	16	32	3	6	3	6	1	2
Friends	7	14	2	4	4	8	6	12
Broker	2	4	10	20	5	10	0	0

Farmer's perception of yield constraints: Out of the surveyed population, 19 (38%) were satisfied from their paddy yield and rests of the 31 (62%) growers were not. Several reasons were given regarding yield constraints. Eight (16%) farmers pointed out water shortage and 23 (46%) reported high cost of inputs and low price of rice in the market as the yield limiting factors (Table 9).

B. Information Access

Education level of the farmers: Out of the 50 farmers interviewed, 8 (16%) farmers had primary education, 5 (10%) attained Matric qualification, 11 (22%) were intermediate, 4 (8%) were graduates, 4 (8%) were post-graduate and 18 (36%) were computed as illiterate (Table 10). Thus, a big segment of the population (36%) had no formal education.

Sources of information: The trend of the sampled population towards getting information on rice from different sources is given in Table 11. The frequency of the sampled population in getting information from nearby growers was very high i.e.13 (26%), as compared to other sources of information. Similarly, 10 (20%) growers did not want to get information from the Agricultural Research System because of the low intensity of the visits to farmer's field. Out of the 50 (100%) farmers contacted, 16 (32%) growers did not respond to this questionnaire.

Favourite source of information: Out of the total surveyed population, 18 (36%) rice growers indicated the Agricultural Research System as their preferential source in getting information about rice crop as compared to other sources (Table 12). The rest of the farmers showed variable responses in selecting their favourite source towards rice cultivation. Sixteen (32%) growers did not respond to this questionnaire.

Effective source of information: Among the farmers interviewed, sixteen (32%) farmers had the view that the information provided by nearby growers was most effective, followed by the Agricultural Research System. Radio, although, is a powerful medium of communication in the present era of information technology, but most of the farmers 10 (20%) pointed out that this medium is less effective – as it provides only information not the practical demonstration (Table 13). Response of growers towards the effectiveness of other sources of information was quite inconsistent. Sixteen (32%) growers did not respond to this questionnaire.

Role of information sources: A big segment of 17 (34%) growers of the sampled population agreed that the role of nearby growers in providing information about rice crop was very positive (Table 14). Similarly, 6 (12%) had the view that the role of Agricultural Research System is also very positive. Unlikely, 12 (24%) and 10 (20%) growers of the surveyed population reported negative role of Agricultural Research System and Agricultural Extension department. The trend of the population interviewed towards the role of Radio was similar as they responded to previous questionnaires. The role of pamphlets in providing information and dissemination of improved technologies was also recognized by 4 (8%) growers. However, sixteen (32%) growers did not respond to this questionnaire.

C. Extension Services: A number of channels (Farm visits, exhibitions, field days and demonstrations) were examined regarding their role in dissemination of rice technology. Out of the sampled farmers, 29 (58%) showed complete dissatisfaction on the performance of Extension department in educating farmers and providing sufficient information about rice crop. Only 5 (10%) farmers were satisfied with their performance. While, sixteen (32%) growers did not respond to this questionnaire.

Channels of extension services: Among sampled population, 13 (26%) farmers reported occasional visits of extension workers while 8 (16%) had the view that the extension workers transmitted no practical knowledge through demonstration. Ten (20%) growers replied that none of the extension worker transmitted knowledge either through field visits or field days (Table 15). Sixteen (32%) growers did not respond to this questionnaire.

Effective channel: A big segment of the sampled population agreed that farm visit was the most effective channel, followed by demonstration plots and field days (Table 16). The farmers' were of the view that they could learn a lot in the field, if the extension workers paid visits to them frequently.

D. Credit: Twenty-seven (54%) of the farmers interviewed needed loan for the purchase of fertilizers and insecticides etc for rice crop. The population not using the credit put forth the reasons that credit is not available when needed and interest rate is also high. However, sixteen (32%) growers did not respond to this questionnaire.

Suitable source: Out of the three sources available for credit, thirty-two percent of the population declared banks as the suitable source of credit, followed by friends. Ten (20%) farmers having smaller holdings were dependent on Broker because of their convenience. They took loan from the Broker for the cultivation of crop and repaid after it's harvesting (Table 17). Sixteen (32%) growers did not respond to this questionnaire.

Final thought: The study aimed at exploring social and input variables associated with successful rice production in Dera Ismail Khan, NWFP, Pakistan. The survey revealed an important noting that despite of prevailing illiteracy and low livelihood status, most of the farmers are using recommended rice production technology and optimal input application required for improved rice yield. However, potential yield is yet to be achieved. This is attributed to a number of constraints including local factors (unstable market for produce purchase and input costs, skilled labour scarcity at the time of transplanting), which need to be streamlined. High reliance on fellow farmers regarding information access and usage has provided an insight into the role of extension services, which requires reorientation and increased contacts for effective results. Farmers need to follow optimal plant population necessary for achieving potential rice yield. Hence an integrated effort is needed by all stakeholders involved in rice production in order to mark potential yield.

ACKNOWLEDGMENTS

The untiring efforts and cooperation of Mr. Khan Zaman, Mr. Mohammad Jan and Mr. Khalid Abdullah are very gratefully acknowledged.

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