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# Recommended Technologies and Production Practices at Farm Level: Wheat Scenario

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## Abstract

**The adoption of technologies has been the concern of developing countries. The assessment of adoption process provides valuable information to the researchers, extensionists and policy makers to identify reasons of low yield. The present study aimed to observe the adoption level of farmers for wheat production technologies. A questionnaire was designed to gather information especially about the awareness and adoption of various aspects of wheat production technologies. A formal survey was conducted in the year 2005. Three districts (Sialkot, Gujranwala and Sheikhupura) of rice-wheat cropping zone and three (Faisalabad, T.T.Singh and Jhang) of mixed-wheat zone were selected for the present study. A sample of 180 wheat growers (90 from each zone) was selected randomly for data collection. The results of the study indicated that some recommended technologies like land preparation, varieties, irrigation and weed control were well adopted by farmers while others like sowing time, sowing method, seed rate and fertilizer application were not well adopted. For instance, the study results revealed that only 54 percent of the respondents planted wheat in time and only 45 percent of the farmers applied wheat seed as per department recommendation. The farmers of survey area generally applied Nitrogen and Phosphatic fertilizers but they were not applying the Potash which is an important nutrient for the crops. Only 2 percent of the respondents applied fertilizer according to the recommendation of the department. So, there is strong need to intensify adoption of recommended technologies. As for as sources of information for dissemination of recommended production technologies are concerned, majority of the farmers (about 70 per cent) got information from fellow farmers followed by extension department (about 62) percent and mass media about (49 percent). The role of mass media is more important in the modern technological era but it is not being properly utilized.**

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**Key Words:** Recommended technologies, Dissemination, Adoption, Punjab

## Introduction

Pakistan is predominantly an agricultural country. However, agricultural production of almost all the crops obtained in the country is far less than that is achieved in developed countries. The crop production technologies developed through research system are there but their wider adoption remains quite limited. This situation calls for a system, which ensures efficient and effective information flow from researchers to the farmers and vice versa. This can revolutionize our agricultural economy and can place it on sound and stable lines.

Wheat is the leading food grain and staple diet of the people of Pakistan. The wheat straw is also important for livestock feed. Wheat contributes 13.8 percent to the value added in agriculture and 3.2 percent to GDP (GOP, 2004). Consequently, it occupies a central position in agriculture policies. It is grown on approximately 8 million hectares, which is the largest acreage of any crop during any crop growing seasons. The annual wheat production was about 19 million tones (GOP, 2004). The annual requirement of the country works out to be about 20 million tones.

Pakistan has been the net importer of wheat for the past several decades. This situation is not enviable. It is believed that future increase in wheat yield will come through yield enhancement since land area will decline. Area under wheat should preferably be decreased to accommodate pulses and oilseed crops to overcome the gap in their supply and demand. Efforts to increase the wheat productivity have always been the concern of the research system. The experts have developed technologies for wheat production through research. In agriculture, production technology may be an input, use of an implement, practice to increase yield or save time. Agricultural department of the provinces publish brochures and booklets for recommended production technologies for each crop. These are considered as recommended technological package for crops. The technologies explained in the technological packages include varietal selection, land preparation, sowing schedule, seed rate, application of fertilizers, irrigation schedule, weed control, insect pest and disease control and harvesting schedule. It is believed that by adopting these recommended technologies farmers can get higher yield.

The present study has been designed with the major objective to estimate the adoption of wheat production technologies, in the form of a package of technologies at farm level. The specific emphasis is on the package of wheat production technologies.

Numerous studies have been conducted on the adoption of individual technologies but rare effort has been made in the past to determine the extent of adoption of crop production technologies as a whole.

## Materials and Methods

The aim of this study was to conduct detailed investigation to assess the adoption of wheat recommended production technologies in the Punjab. However, in an empirical investigation it is impossible to collect information from the whole population. Therefore researchers are often forced to make inferences based on information from a representative sample of the population. The size of sample, and amount of variation, usually affect the quantity and quality of information obtained from the survey. The aim was to devise sampling scheme, which is economical and easy to operate and provide unbiased estimates (Barnett, 1991).

The study was confined to the Rice-Wheat and Mixed cropping zones of the Punjab. Three important districts of rice-wheat zone namely Sialkot, Gujranwala, Sheikhupura and three districts of mixed zone namely Faisalabad, Jhang and T.T. Sigh were selected for the present study.

The information on all the aspects of wheat production was gathered from the agricultural extension and research institutes. For this purpose a document "Wheat production technologies", published by the Agriculture Department was considered as a reference for standard technological package for wheat production. A structured survey tool; questionnaire was designed on the basis of the informal survey and secondary information sources. The questionnaire was pretested before the formal survey at farm level. A sample of 180 wheat growers was randomly interviewed (90 from each zone) for the collection of requisite data. The respondents were classified into three categories of small (less than or equal to 5 hectares), medium (greater than 5 hectares and less than or equal to 10 hectares) and large (greater than 10 hectares) on the basis of their land holdings for the purpose of data analysis.

The data thus obtained were analyzed by using simple statistics to estimate the various responses and draw conclusions for pertinent recommendations. The distribution of sampled respondents on overall basis and by cropping zones is given in Table 1.

**Table 1: Distribution of Sampled Respondents**

| Cropping Zones | Small | Medium | Large | All |
|---|---|---|---|---|
| | Number | | | |
| **Rice-Wheat** | **49** | **22** | **19** | **90** |
| Sialkot | 16 | 8 | 6 | 30 |
| Gujranwala | 16 | 6 | 8 | 30 |
| Sheikhupura | 17 | 8 | 5 | 30 |
| **Mixed** | **56** | **25** | **9** | **90** |
| Faisalabad | 20 | 8 | 2 | 30 |
| Jhang | 15 | 11 | 4 | 30 |
| T.T.Singh | 21 | 6 | 3 | 30 |
| **Both Zones** | **105** | **47** | **28** | **180** |

## Results and Discussion

The detail analysis of the survey data and discussion on the results is presented in this section.

**Land Holding**

The farmers on overall basis had an operational land holding of about 7 hectares. They had allocated 69 percent of the area to wheat in Rabi season and 48 percent to Rice and 12 percent to sugarcane in Kharif season (Table 2).

**Table 2: Land Holding of Sampled Respondents**

| Land Holdings | Both Zones | | | |
|---|---|---|---|---|
| | Small | Medium | Large | All |
| | Hectares | | | |
| Owned Farm Size | 2.74 | 7.03 | 14.27 | 5.65 |
| Rented in | 0.25 | 1.44 | 6.40 | 1.52 |
| Rented out | 0.11 | 0.71 | 0.20 | 0.28 |
| Shared in | 0.12 | 0.27 | 1.52 | 0.38 |
| Shared out | 0.03 | 0.62 | 0.28 | 0.23 |
| Total Farm Size | 2.98 | 7.42 | 21.72 | 7.05 |
| Cultivated | 2.92 | 7.35 | 21.39 | 6.95 |
| Uncultivated | 0.05 | 0.04 | 0.32 | 0.09 |
| **Rabi Crops** | | | | |
| Wheat | 1.94 | 4.86 | 15.60 | 4.83 |
| Rabi fodder | 0.59 | 1.15 | 1.51 | 0.88 |
| Other rabi crops | 0.11 | 0.38 | 2.55 | 0.56 |
| Fallow rabi | 0.14 | 0.51 | 0.73 | 0.33 |
| **Kharif Crops** | | | | |
| Rice | 1.06 | 2.82 | 12.92 | 3.36 |
| Sugarcane (Ratoon) | 0.13 | 0.43 | 0.98 | 0.34 |
| Sugarcane (Fresh) | 0.30 | 0.73 | 1.21 | 0.55 |
| Kharif fodder | 0.80 | 1.24 | 1.73 | 1.06 |
| Other Kharif crop | 0.24 | 0.80 | 1.83 | 0.63 |
| Fallow kharif | 0.39 | 1.32 | 2.70 | 0.99 |

**Wheat Production Technologies**

Wheat production technologies include recommended use of inputs, practices and procedures at different stages of the crop from sowing to harvesting. The farmers were inquired about their awareness of recommended land preparation practices, varieties, sowing time, sowing method, seed rate, fertilizer application, irrigations and weed control. Then, it was noted whether their practices were in line with production practices recommended by the government or not.

**Awareness about recommended production technologies of wheat**

The survey results revealed that on overall basis about 47 percent of the respondents were aware of recommended land preparation practices, about 60 percent were aware of varieties, 68 percent about sowing time, 90 percent of sowing method and 70 percent for seed rate. The awareness about fertilizer application, irrigation and weed control was 51 percent, 74 percent and 86 percent of the total farmers respectively (Table 3). The large farmers had naturally more awareness about most of the recommended operations as they had more access to information and media.

**Table 3. Awareness about Recommended Production Technologies of Sampled Respondents**

| Production Technologies | Both Zones | | | |
|---|---|---|---|---|
| | Small | Medium | Large | All |
| | Percent | | | |
| Land preparation | 50.00 | 41.30 | 48.10 | 47.40 |
| Varieties | 58.00 | 50.00 | 64.30 | 59.60 |
| Sowing time | 67.70 | 61.40 | 77.80 | 67.70 |
| Sowing method | 92.70 | 86.50 | 88.50 | 90.30 |
| Seed rate | 67.70 | 65.10 | 85.20 | 69.90 |
| Fertilizer application | 47.10 | 59.10 | 55.60 | 51.40 |
| Irrigations | 72.40 | 69.80 | 88.50 | 74.10 |
| Weed control | 85.70 | 84.10 | 89.30 | 85.90 |

**Sources of Information of Recommended Production Technologies**

The important information sources for dissemination of agricultural technologies are listed in Table 4. On overall basis, majority of the farmers about 70 per cent got information about recommended production technologies from fellow farmers, followed by extension/ research system (about 62 per cent). government and mass media (about 47 per cent). Among farm size categories, the large farmers about 70 percent got information about recommended production technologies from extension and research departments which was higher as compared to small and medium farm groups. Small farmers mainly (76.7 per cent) got information from fellow farmers as given in Table 4.

**Table 4. Sources of Information of Sampled Respondents**

| Information Sources | Both the Zones | | | |
|---|---|---|---|---|
| | Small | Medium | Large | All |
| | Percent | | | |
| Extension/Research | 60.20 | 60.90 | 70.40 | 61.90 |
| Mass Media | 42.70 | 55.30 | 59.30 | 48.60 |
| Fellow Farmers | 76.70 | 63.80 | 53.80 | 69.90 |
| Private Dealers | 22.30 | 21.30 | 48.10 | 26.00 |
| Other | 1.00 | 4.30 | 3.70 | 2.30 |

**Adoption of Recommended Wheat Production Technologies**

Adoption of technology is a process in which farmers go through various stages from awareness to final performing the practice. In agriculture, production technology may be an input, use of an implement, practice or a procedure to overcome a difficulty, to increase yield or save time (Sheikh et al. 2003).

The agricultural research system develops technologies for increasing agricultural production to meet the demands of rapidly growing population of the country. Technology development requires lot of efforts and time. After the development, the technologies are disseminated among the farmers through agricultural extension system and other means of technology transfer. The awareness about technologies does not guarantee the adoption of technologies. The adoption of technologies mainly depends on the socioeconomic conditions of the farmers. Wheat production technologies are discussed in detail in the following section. Table 5 shows the status of the adoption of recommended technologies at farm level.

**Table 5. Adoption of Recommended Production Technologies by the Sampled Respondents**

| Production Technologies | Both the Zones | | | |
|---|---|---|---|---|
| | Small | Medium | Large | All |
| | Percent | | | |
| Land preparation | 82.40 | 80.90 | 88.90 | 83.00 |
| Varieties | 79.30 | 73.30 | 82.10 | 78.20 |
| Sowing time | 50.50 | 56.50 | 64.30 | 54.20 |
| Sowing method | 30.30 | 15.60 | 32.10 | 26.70 |
| Seed rate | 39.00 | 48.90 | 60.70 | 45.00 |
| Fertilizer application | 2.90 | 0.00 | 3.60 | 2.30 |
| Irrigations | 86.40 | 91.30 | 89.30 | 88.10 |
| Weed control | 77.70 | 65.20 | 85.70 | 75.70 |

**Land preparation**

Land preparation is the first and important activity to be performed for wheat production. About 83 percent of the farmers on overall basis prepared the land as recommended by the experts. The adoption of land preparation practices was higher among large farmers as compared to small and medium farmers.

**Varieties**

Crop production largely depends on the choice of variety. Then the seed must be healthy, cleaned and treated to get higher yield. If the choice and practices

are right as recommended by the experts for that particular area, then there will definitely be higher yield otherwise vice versa. The introduction of high yielding varieties and rate at which they are diffused among the farmers' fields indicate the speed of transferring the benefits of breeding efforts to farmers. Pakistan is one of the countries where wheat varietal substitution has been very slow (Byerlee 1993). However survey results revealed that about 78.20 percent of the respondents on overall basis adopted the recommended varieties. The adoption among the large farmers again was higher as compared to small and medium farmers (Table 5). This highlighted the fact that they have more access and resources.

**Sowing time**

Timely sown wheat gives higher yield and delayed sowing affects the yield. The wheat experts said that one-day delay after November 20 reduces the yield from 15 to 20 kg per acre (Khan 2003). The majority of the previous studies strongly suggest that for obtaining optimum yield under irrigated environment, wheat sowing should be done in the month of November (Hussain 1995). The wheat sowing is delayed in the Rice-Wheat zone because of late rice harvesting. Similarly, the reason behind late planting of wheat in the mixed cropping zone was the late harvesting of sugarcane crop and shortage of canal irrigation water. The zero tillage sowing technology for wheat has solved this problem in the rice-wheat system to some extent. The survey results on overall basis revealed that only 54 percent of the respondents planted wheat in time.

**Sowing Method**

The agricultural experts recommended drill sowing rather broadcast method. However, farmers generally practiced broadcast method for wheat in order to save time as the sowing drill was not commonly available. The survey results highlighted the same fact that on overall basis only 27 percent of the growers practiced drill sowing as per recommendation of the department.

**Seed Rate**

The recommended seed rate for timely wheat sowing is 125 kg per hectare. If the sowing is to be done in December, then the recommended seed rate is 175 kg per hectare. The farm level practice was contrary to it, the farmers generally applied seed 100 kg per hectares for timely sowing, and 125 kg per hectare for December sowing. Only 45 percent of the farmers on overall basis applied seed as per department recommendation.

**Fertilizer Application**

Fertilizer is a key input for better crop production. The timely and balanced doze of fertilizer give higher yield or vice versa. It was noticed that farmers applied Nitrogen and Phosphorous fertilizers but not Potash which is also important nutrient. The survey results revealed that on overall basis only 2 percent of the growers applied fertilizer according to the recommendations of department.

**Irrigations**

Wheat crop require 3 to 4 irrigations at different stages of growth. There are three critical stages i.e. first irrigation normally 20-25 days after sowing, second at booting stage and third at milking stage of grain development. About 88 percent of the respondents applied irrigation as suggested by the agricultural department (Table 5).

**Weed Control**

Weed control is important to get higher yield of any crop. According to an estimate, weeds reduce the wheat yield by 12 to 35 percent depending on their intensity (Khan, 2003). There were 75 percent of the respondents on overall basis who applied weedicide as per departmental recommendations (Table 5).

**Harvesting and Selling of Crop**

Table 6 depicts results of harvesting methods adopted, yield and sale of the produce to different agencies by the respondents. Manual as well as mechanical harvesting of the crop in the study area was noticed. Manual harvesting was more common in the mixed-wheat zone. However, mechanical harvesting was generally done in the Rice-Wheat zone. The obvious reason was to save time because of late maturing of basmati rice. The average yield on overall basis was about 3346 kilograms per hectare. There was no much significant difference in the average yield across farm size categories. The yield ranges from 3228 to 3689 kilogram per hectare.

## Conclusions and Recommendations

The results of the study clearly indicate that some recommended technologies like land preparation, varieties, irrigation and weed control are well adopted while others like sowing time, sowing method, seed rate and fertilizer application are not well adopted. As sources of information for recommended production technologies, majority of the farmers got information from fellow farmers followed by extension department and mass media. The role of mass media is more important in the modern technological era but it is not being properly utilized.

- The majority of the farmers failed to timely sowing of wheat crop due to number of reasons. There was serious decline of yield due to late planting. If we only manage the timely planting of crop, then we will definitely come out of the list of wheat importing countries.
- Similarly sowing method and seed rate applied by majority of the farmers were not as per recommendation of the department. So, there is

strong need to increase the rate of adoption of these technologies.

- The adoption of fertilizer application as per departmental recommendation was the lowest among all the wheat production technologies. Therefore, the reasons of low adoption need to be seriously reviewed and properly tackled in order to improve the fertilizer application practices.
- The adoption of weed control practices was high among the sampled farmers. The efforts should be made to further improve the adoption of recommended weed control practices because weeds do have serious impact on yield reduction.
- Majority of the sample farmers (84 percent) had small land holdings less than 10 hectares. Therefore, to sure the adoption of recommended technologies, the timely availability and quality of critical inputs be made ensured for small farmers.
- The mass media prove fundamental in the dissemination of agricultural technologies in the modern technological era. There is need to effectively utilize all the sources of mass media. This will help improving the awareness and adoption of recommended technologies, which ultimately lead to higher crop production.

**Table 6: Harvesting and Selling of Wheat Crop by the Sampled Respondents**

| Characteristics | Both the Zones | | | |
|---|---|---|---|---|
| | Small | Medium | Large | All |
| **Harvesting method** | Percent | | | |
| Manual | 61.90 | 58.70 | 25.90 | 55.60 |
| Combine Harvester | 22.90 | 23.90 | 44.40 | 26.40 |
| Rapper | 3.80 | 4.80 | - | 3.40 |
| Both | 11.40 | 13.00 | 29.60 | 14.60 |
| Yield (kg. /hectare) | 3242 | 3489 | 3512 | 3346 |
| Home Consumption (kgs.) | 2202 | 3054 | 4360 | 2680 |
| **Purchasing agencies** | Percent | | | |
| Commission Agent | 47.60 | 40.90 | 52.00 | 46.40 |
| Beopari | 25.00 | 34.10 | 24.00 | 27.50 |
| Fellow Farmers | 16.70 | 11.40 | 8.00 | 13.70 |
| Flour Mill | 6.00 | 6.80 | 8.00 | 6.50 |
| Other | 4.80 | 6.80 | 8.00 | 5.90 |
| Selling price (Rs. Per/40 kg.) | 399.50 | 407.75 | 401.48 | 402.18 |

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