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RESPONSIVENESS OF SUBSISTENCE FARMERS TO NEW IDEAS: DWARF WHEATS ON UNIRRIGATED SMALL HOLDINGS IN PAKISTAN

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Barani smallholders have adopted dwarf varieties of wheat in a remarkably short time. Significant in diffusing the new technology were the many types of interpersonal and mass media communication channels which informed the farmers that dwarf wheats are higher yielding than desi wheats. Interpersonal contacts between villagers created the most awareness. Of the mass media channels of communication, the radio was important in Hazara. In addition, demonstration plots on farmers fields made it possible for the potential adopters to see the striking differences between desi and dwarf yields. Technical and economic factors largely influenced the farmer to try dwarf yields: (1) yields were consistently better with dwarfs, ~~(2) to increase output and, in concert~~, (3) no major changes were required in the cropping pattern. The primary effects of technological change with dwarf wheats at the farm level were: (1) to increase cropping intensity, (2) to increase output and, in concert, (3) to generate employment. Long term effects are becoming evident with increased social interaction between farmers and extension people and a greater move towards a money economy. ~~In sum, barani smallholders are highly responsive to significantly "better" innovations which are neutral to scale. They are equally responsive and reachable by mass media and interpersonal channels of communication.~~

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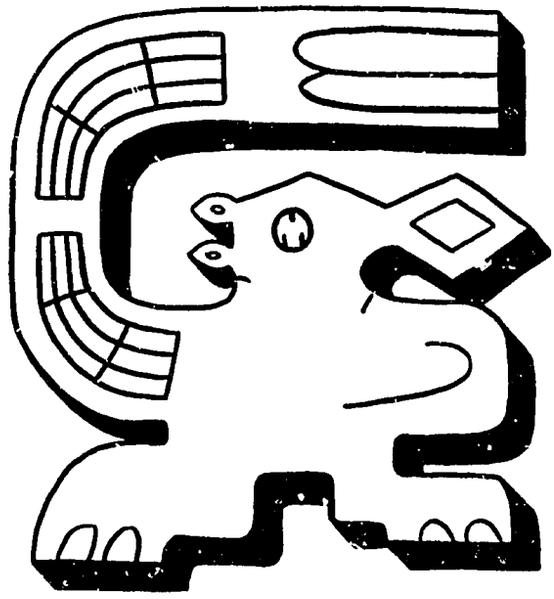

Responsiveness of Subsistence Farmers to New Ideas: Dwarf Wheat on Unirrigated Small Holdings in Pakistan

by Refugio I. Rochin

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Responsiveness of Subsistence Farmers to New Ideas: Dwarf Wheats on Unirrigated Small Holdings in Pakistan

REGGIO L. ROCHIN

Most of the events and choices that make up the life of a subsistence farmer are difficult to analyze in the usual economic terms. This study by Refugio Rochin (University of California, Davis) suggests that as a result the readiness of such farmers to consider new ideas is often underestimated. When an innovation satisfies the subsistence farmer's needs and is within the range of his resources, as dwarf wheat did in the region studied, he turns out to be as interested and responsive as any other agricultural producer. Local extension agents played a key role, both in carrying information and in establishing demonstration plots. This suggests that keeping its own field agents well informed and properly supported may be the most important step an agency can take in communicating with farmers.

Dwarf wheats are high-yielding varieties of wheat which were developed in Mexico and have been imported and multiplied in West Pakistan. Their diffusion and widespread adoption on irrigated land in the past five years have been instrumental in West Pakistan's attaining food grain self-sufficiency.

What has contributed to this remarkable achievement has been a combination of a 25 percent increase in wheat acreage and a 35 percent increase in yields to a new record high in 1969-70 of 12.9 maunds per acre.

Governmental season and crop reports show the following changes in West Pakistan wheat acreage and yields in recent years:

Year	Acreage	Yields in Maunds per Acre		
		All Wheat	Irrigated Wheat	Barani Wheat
1964-65	13,140,000	9.4	11.3	5.7
1965-66	12,738,000	8.2	10.1	4.2
1966-67	13,205,000	8.8	10.9	3.9
1967-68	14,785,000	11.6	13.9	6.2
1968-69	15,221,000	11.6	14.1	4.5
1969-70	15,089,000	12.9	17.2	4.4

Of the wheat acreage, 70 percent is irrigated and 30 percent is *barani*, or rainfed.[1]

On irrigated land the average wheat yields have increased by as much as 70 percent in recent years. Little is known about the impact of the new wheat varieties in less favorably endowed areas of West Pakistan where water supplies are uncertain and where farmers are subject to a great deal of risk in experimenting with yield-changing innovations.

On top of this, there has been only a modest effort given to research on wheat production on barani land, and only sporadic study of the socioeconomic characteristics of barani farmers.

In particular, little is known about these farmers' methods of cultivation, standard of living, and willingness to accept innovations.[2] What is available

1 Barani literally translated from Urdu means depending on rainfall. It is a commonly used agricultural term in West Pakistan referring to rainfed and or unirrigated land.

2 For one known study see: Stutt, Daniel W. "Producer Response to Technological Change in West Pakistan," *Journal of Farm Economics*, Vol. 47, No. 3, August 1965, pp. 625-633.

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often takes a negative view of the barani farmers living in the northern regions of West Pakistan. They are thought to be resistant to change and to maintain irrational farm management behavior.[1]

This study has attempted to describe the process of dwarf wheat adoption among a sample of barani smallholders in Pakistan. Specifically, we are interested in:

(1) The extent to which barani smallholders are using new technology, and their willingness and ability to do so.
(2) Those communication channels involved in prompting barani smallholders to substitute a new technology (a new dwarf wheat variety) for one with which they are familiar.
(3) Impact of technological change, by way of dwarf wheat adoption, on resource use, productivity and farm output of the barani smallholder.

SURVEY LOCATIONS AND SAMPLE CHARACTERISTICS

Field surveys for this study were conducted in Hazara District of the North West Frontier Province. The district is characterized by rough and mountainous terrain. Even though it comprises a total area of four million acres, only about six hundred thousand acres are cultivated annually. Of the cultivated acreage, 85 percent is exclusively barani (dependent solely on rainfall as a source of water).

Approximately 30 percent of the District's cropped area is sown with wheat during the winter (rabi) season. Barani wheat covers 88 percent of the District's two hundred thousand wheat acres. About 45 percent of the cropped area is sown with maize during the summer (kharif) season in Hazara and 88 percent of its 290 thousand maize acres are strictly rainfed.

Hazara's agricultural sector, which holds 95 percent of the District's population, faces two interrelated problems of constant urgency: intense population pressure and poverty.

In 1961, approximately 1.38 million people lived there. Today there might be more than 1.6 million. Since it has been difficult to increase productivity and cultivable area in Hazara, all increases in population have made it notably difficult to raise per capita incomes.

Those living in Hazara are generally poor. According to the 1960 Agriculture Census, 77 percent of the 270 thousand farms are less than five acres in size; barely two percent are larger than 25 acres. Almost all farmers own their land, live on hillsides and farm multi-terraced plots. Subsistence crop production of maize and wheat is their main agricultural pursuit.[4]

Rough topographic conditions have made it difficult for tractor mechanization and irrigation schemes to penetrate the District.

Lora and Oghi: Survey Locations

Data for the study were collected during two field surveys in 1970 which coincided with the post-harvest periods for wheat and maize: June and November, respectively.

The first survey ended up with 143 interviews with barani smallholders. In the second survey 98 farmers were interviewed. Due to the particular sampling technique used, 15 farmers were interviewed twice, and on a few occasions smallholders could not answer questions well. Thus, the size of sample for certain questions changes in the following analysis.

The sample of respondents was chosen from villages of Oghi and Lora thanas,[5] which are relatively large geographic areas representative of most of Hazara District. The two thana areas are a hundred miles apart and hold a number of interesting contrasts and similarities.

Oghi has rich forested land and Lora is practically deforested and subject to extensive erosion and soil deterioration. Both grow primarily wheat in winter and maize in summer.

Annual rainfall for the last ten years has averaged around 45 inches in Oghi and 52 inches in Lora, with plus or minus five inches of rainfall in any given year for each area. Both areas experience heaviest precipitation during the combined months of July-September and February-April. However, the former monsoon period is also the hottest with

3 Sher, A. C.M. *Farmers' Attitudes Toward Self-Help*, Pakistan Academy for Rural Development, Peshawar, North-West Frontier Province, 1965, p. 18.

4 A village study conducted in Hazara during 1955 pointed out that maize was the main subsistence crop and that wheat was "not so commonly consumed by the villagers." In more recent years, though, wheat has become as important as maize in terms of production and consumption by Hazara's farmers. Mahjub, Hussain, *A Socio-Economic Survey of Village Batta in Hazara District of the Peshawar Division*, Board of Economic Enquiry, Peshawar University, North West Frontier Province, Pakistan, 1958.

5 "Thana" means police station in Urdu. Such police stations are located in the larger cities which serve as main marketing centers. Each thana has a certain jurisdiction over a number of villages known to the villagers and, in turn, each villager can identify himself with "his thana."

temperatures soaring to 100 F during the day, resulting in a high rate of evapotranspiration which nearly matches the rate of precipitation.

Rainfall is extremely erratic. It falls in explosive torrents and is very unpredictable in where it hits; one field may receive the brunt of a thundershower and a neighboring field may continue to suffer from drought. Many barani farmers still adhere to the practice of leaving land fallow each growing season in order to "give the land rest and rebuild its power."

Salient Characteristics of Barani Smallholders

Approximately 96 percent of the sample of respondents cultivate less than 15 acres, 34 percent cultivate less than 2.5 acres. About 82 percent of the respondents own their land, 4 percent both own and rent land and the rest are tenants. However, tenants usually are not paying rent since their land is in disputs under land reform legislation.

Nearly all of the farmers struggle with small and widely separated plots. Each plot averages around a quarter of an acre in size and farmers cultivate on the average as many as 15 individual and separate plots that are terraced and generally scattered. Government efforts to consolidate holdings have so far been futile.[6]

Most families live in homes made of rock covered over with hand-molded mud. The average family has a few fruit and or nut trees spotted around the home, a buffalo and or goat for dairy foods, some chickens, and a pair of bullocks for plowing. Some homes have a private well for drinking water or a nearby well shared by village neighbors; none of the villages have indoor plumbing.

Village homes are without electricity; the kerosene lamp is now replacing the candle. Wood and fuel oil are used for heating and cooking. Due to the cost and scarcity of both, however, cowdung mixed with straw is more frequently burned. Latrines are not to be found. Few homes are located near an all-weather road. Most are nestled against protective mountain sides. Provisions have to be carried by hand or sometimes by rented donkey for a small carrying fee.

The extended families average between ten and eleven people, about 2 to 3 per cropped acre. Most extended families have relatives employed outside the village area. Some husbands who work in Karachi city, a thousand miles away, keep their wives and children on the farm.

The heads of household interviewed in the survey averaged 47 years of age. Although 45 percent said they were literate, they appear to read with considerable difficulty. More and more of the younger males are sent to rudimentary primary schools, mostly in anticipation of leaving the farm by the time they reach 20 years of age.

The typical family's total income is about $235 a year.[7] About $150 is the value of the farm-produced crops, wheat, maize, a little rice, with their straw and hay cut from the surrounding hills. Another $25 is earned by the farmer at other jobs in the village. The rest of the income, $60, comes from relatives employed away from the village who send money orders or cash to the family on the farm.

Little of the grain produced by these farmers reaches the market. If a farmer sells any, it is only when debts fall due or when cash is needed to cover costs of medicine or wedding ceremonies. The poorest families consume practically nothing besides the grain they produce.

Overall, the barani smallholders of Hazara District do not appear to be likely candidates to adopt innovations. They simply cannot afford to risk losses in crop production. Yet with limited agricultural advances and a rapid growth in population, Hazarans will continue to add to the mainstream of people joining urban concentrations, a prospect the country can ill afford.

Sources of Dwarf Wheats[8]

Dwarf wheats were brought into Hazara District by the field staff of the Regional Department of Agriculture, by the Agricultural Development Corporation, and by some farmers.

The first shipment of 400 maunds (enough seed for about 4000 acres) was distributed to different areas of the District in 1966-67 for use on irrigated land and sown by the field extension staff on a number of controlled and carefully selected "demonstration plots." At that time, each bag of dwarf wheat cost the government Rs. 54 per maund, compared to Rs. 20 per maund for the best desi (traditional) varieties.

6. Royal S.M.Z. et al. *Consolidation of Holdings: A Study of the Process of Consolidation of Agricultural Holdings in Selected Villages in Peshawar District*, Pakistan Academy for Rural Development, Peshawar, West Pakistan, January 1965.
7. Estimated on the basis of the international exchange rate of ten rupees per U.S. dollar.
8. General historical coverage of dwarf wheat diffusion and adoption in West Pakistan is found in: Eckert, Jerry B. *The Impact of Dwarf Wheats on Resource Productivity in West Pakistan's Punjab*, unpublished Ph.D. dissertation, Michigan State University, May 1970, Chapter II, pp. 12-36.

In 1967,68, nine thousand maunds of dwarf wheat were commercially available to the farmers through the Agricultural Development Corporation.

By 1968 69, dwarf wheat seed reached a significant number of the farmers' fields. The Agricultural Development Corporation (ADC) sold a smaller amount (5,500 maunds) than the year before and at a lower price of Rs. 22 per maund.

In 1969 70, the year of this survey, enough seed was trading hands from farmer to farmer and relatively little was sold by the ADC.

TIME PATTERNS IN DIFFUSION OF DWARF WHEAT AND FERTILIZER[9]

The Lora and Oghi areas showed a rapid rate of diffusion of new dwarf wheats, particularly Mexipak-65,[10] and fertilizer.

(1) First Use of Fertilizers and Dwarf Wheats

Table 1 shows the number of respondents who used dwarf wheats and chemical fertilizer for the first time each year since 1966-67. Initially, fewer than one percent of the sampled barani smallholders were using dwarf wheats. During the same year, a slightly larger fraction of farmers used chemical fertilizer. By 1969 70, the majority of barani smallholders had already tried dwarf wheats and fertilizer for the first time

Overall, these findings clearly indicate that barani smallholders are responsive to innovations and will make rapid adjustments in resource allocation with new varieties of seed and fertilizer.

Table 1. **Dwarf Wheat and Chemical Fertilizer Used for the First Time per Respondent by Year: Lora and Oghi Thanas, Hazara District, West Pakistan.**

	DWARF WHEAT[a] (n = 226)			CHEMICAL FERTILIZER[b] (n = 95)		
Growing Period for Wheat	No. Each Year	Cumulative Number	Cumulative %	No. Each Year	Cumulative Number	Cumulative %
1966 67	2	2	0.83	3	3	3.16
1967 68	28	30	13.26	5	8	8.42
1968 69	45	75	33.17	20	28	29.47
1969 70	75	150	66.35	30	58	61.05
1970 71[c]	50	200	88.47	11	69	72.63

a Respondents' anticipated use
b Data collected from first and second surveys
c Data collected from second survey

(2) Dwarf Wheat Acreage

Table 2 gives the average area sown with dwarf wheat and the percentage of total wheat area per respondent in the Lora and Oghi areas. In 1966 67, six kanals were sown with dwarf wheat by two farmers in the sample. In the following years other farmers went through a period of experimentation and acquaintance with the variety. Few, if any, sowed 100 percent of their wheat area with the new variety during the first two years. Between 1968 69 and 1969 70 growing periods, more farmers with smaller holdings began to use dwarf wheats. But due to the increasing proportion of smaller farms among these new users, this did not sharply increase the percentage of total wheat area in dwarf wheats.

Table 2 **Dwarf Wheat Area Sown and Percentage of Total Wheat Area per Respondent by Year**

	DWARF WHEAT	
Growing Period	Average Number of Kanals Farm[a]	Percentage of Total Wheat Area Farm
1966 67[b]	3.0	30.00
1967 68	6.2	34.02
1968 69	11.0	65.04
1969 70	11.3	65.90
1970 71	13.8	72.10

a One kanal equals 1/8 of an acre
b Unreliable figures for comparative purposes due to small number of respondents.
c Anticipated area

The survey results also indicate that dwarf wheat growers are sowing more land during rabi (the winter season) and are leaving less land fallow. In other words, they are increasing multiple cropping.

Only one farmer in the sample tried dwarf wheats and subsequently rejected them. The stated reason for this rejection was the "bad taste and quality" of the unleavened bread (chapatti) made from the new wheat; he had a variety with a red-grain which is considered inferior to white-grain. However, the same farmer said he saw some white-grain types (Mexipak-65) in the village and would attempt to acquire enough seed to sow his entire wheat acreage with it.

9 A review of the more recent literature on the process of diffusion is given by Rogers, Everett M. and F. Floyd Shoemaker, *Communication of Innovations: A Cross Cultural Approach* (New York: Free Press of Glencoe, 1970)

10 Mexipak is only one of the commonly used dwarf varieties, but the name is applied to all dwarf varieties by Hazara's farmers

In the group of respondents, two farmers said they had never heard of Mexipak until the time of the interview. Their numbers represent less than two percent of the sample. They do, however, point out the need to know more about the way other farmers become aware of the dwarf varieties of wheat.

METHODS OF DIFFUSION

Communication is defined as the process by which messages are transferred through some channel from a source to a receiver. In this study, the message is an idea that dwarf wheats give higher yields than desi varieties.

There are a number of communication channels through which messages can be conveyed, including interpersonal and mass media channels. Both types function in different ways and their effectiveness also differs according to the way they are used.[11]

A third type of communication channel which is relatively unstudied (but has been employed in Pakistan for over a decade) is the demonstration plot. For comparative analysis it has been grouped with the interpersonal channels in the following discussion.

Both interpersonal and mass media channels were important in creating awareness of dwarf varieties among the sample of respondents (Table 3).

Table 3. **Channels of Communication Which First Informed Respondents of Dwarf Wheats.**

Channels		% of Total Respondents
Mass Media	34	23.78
Magazine (Urdu)	1	0.70
Radio	33	23.08
Interpersonal	107	74.82
Localite	51	35.66
Cosmopolite	32	22.38
Demonstration Plots	24	16.78
Not Aware of Mexipak	2	1.40
Total	143	100.00

(1) Mass Media Channels

Agricultural programs are broadcast daily over the radio in West Pakistan. Many are coordinated with the Bureau of Agricultural Information as part of an Education Extension component. In addition, the Bureau publishes a monthly calendar of the radio programs for their respective areas. Radio programs are presently beamed from Lahore, Rawalpindi and Peshawar. The first two stations broadcast in Urdu Punjabi and the third in Pushto.

Sixty respondents interviewed in Lora said they frequently heard either the Lahore or Rawalpindi agricultural programs. The same number in Oghi said they listened to the Peshawar station. Upon further questioning, however, only half in both locales (30 each in Lora and Oghi) could give the approximate time of the programs they claimed to have listened to. This type of response could indicate that there is an element of status involved in listening to the radio and that more farmers are apt to say they listened to the radio than actually do so. On the other hand, radio programming does change during the year in an effort to have the agricultural program come just after sunset, a time when most farmers are eating their dinner. For future questioning on the impact of radios among farmers, it would be important to know which stations are broadcasting and at what hours in order to cross-check the respondent's answers.

With this precaution in mind, it was found that the radio was the mass media channel most often mentioned by smallholders as their source of information on dwarf wheat performance and availability. Further questioning pointed out that 56 respondents out of 143 (39 percent) owned radios. Ten farmers (7 percent) who did not own radios stated that they were first made aware of the dwarf wheats over this medium.

Altogether, only one smallholder in the sample learned of Mexipak from written media, a magazine written in Urdu. No other type of mass media channel was mentioned by the respondents as a first source of information on the new wheat varieties.

(2) Interpersonal Channels

There are essentially three types of interpersonal channels which informed the barani smallholder of dwarf wheat yields:

(i) **"interpersonal localite"** or those originating within the social system of the receiver, i.e. the neighbors, village shopkeepers, etc.

(ii) **"interpersonal cosmopolite"**, or those channels which have their origins outside the

11 Comparisons are discussed by Everett M. Rogers and Lynne Svenning, *Modernization Among Peasants: The Impact of Communication* (New York: Holt, Rinehart and Winston, Inc., 1969), p. 125

immediate social systems, i.e. agricultural extension personnel and distributors of farm supplies. Both Lora and Oghi cities have offices of the Department of Agriculture, each headed by an Agricultural Assistant (usually a man in his 'thirties with a bachelor's degree in agriculture from Peshawar University). Each Agricultural Assistant, in turn, supervises 3 or 4 Field Assistants (usually men in their late 20s who matriculated in second or third year division and who completed a one-year certificate course in the Agricultural Training Institute in Peshawar). "A Field Assistant is expected to be the Government's principal contact with farmers in the area of one or two Unions, which means 10 – 20 villages, or 10 – 25,000 people."[12]

(iii) **demonstration plots** or visual field displays of agricultural innovations that lead to some discussion among farmers. Both Lora and Oghi areas had demonstration plots installed on farmers' fields by the Field Assistants; six plots in each area in 1967 68 and five plots in the following two years. For 1970 71, the number has been reduced to one each. Their locations were all near the market centers of Lora and Oghi.

The interpersonal localite channels had the largest impact on the farmers. Exchanges between barani smallholders carry the most messages, and the dwarf wheat demonstration plots (which showed striking differences next to desi plots)[13] were also effective transmitters of the dwarf yield message.

It should be noted that Field Assistants (lowest level of extension agents of the Agriculture Department) were very instrumental in diffusing dwarf wheat varieties. Besides personally informing farmers of dwarf wheat potential, they were responsible for the installation of many of the demonstration plots on farmers' fields which, in turn, were catalysts in dwarf wheat diffusion.

Together, both mass media and interpersonal communication channels have important roles to play in introducing innovations to barani smallholders of Pakistan.

DWARF WHEAT PERFORMANCE

Yield appears to be the single most important reason behind dwarf wheat adoption, although farmers named a few other important characteristics:

(1) Dwarf wheats fit the cropping pattern of the farmer and grow in a faster time than desi wheats. Respondents mentioned that desi wheats would not do well if sown after November. On the other hand, they said that dwarf wheats still performed well if sown before the end of December. This is crucial since late rains result in late sowing. In addition, dwarf wheats generally mature 10 to 20 days faster than desi wheats, thus giving the farmer time to clear the field for maize.

(2) Dwarf wheats do not represent complex changes from current practices and are subject to experimentation by individual farmers. A number of tasks are still done in the same way for both desi and dwarf wheats: ground preparation, broadcast sowing, weeding, harvesting and winnowing. Dwarf wheats are neutral to scale, meaning that any size farm can use them. It is evident that barani smallholders initially experimented with handfuls of seed, saw good results with their own experiments and increased the area sown with dwarf wheats the following year. Without this neutrality, it is doubtful that smallholders could have experimented and adopted the variety so willingly.

(3) Some respondents like the bearded features of dwarf wheats because the beard gave some protection against birds. Other respondents stated that they like the taste of the white variety (Mexipak-65).

One complaint was that dwarf wheat gave less fodder. However, barani smallholders were willing to substitute less fodder for a higher grain yield.[14]

12 Davy, Dorcey J. "Improving the Training of Field Assistants in the Agricultural Training Institutes of West Pakistan," mimeo distributed by The Ford Foundation, Islamabad, March 1967, p 4.

13 Dwarf wheat with fertilizer gives a dark bluish-green appearance, desi wheat is light green. Moreover, desi varieties stand taller, have thin stems, and sway freely with the wind, while the high tillering dwarf wheat is short and sturdy against the wind. Mexipak, which is the most commonly used dwarf, has beards and most desi varieties are beardless and hence more likely to be consumed by birds.

14 There is some debate on this point. The usual comparison is to measure one and a half maunds of fodder for every maund of grain of desi wheat produced (1.5:1) versus one maund of fodder for every maund of grain of dwarf wheat (1:1). From this we estimate whether the amount of fodder is more or less by the amount of grain produced. Judging from the farmers' complaints, a more conservative, perhaps more realistic, comparison would be (2:1) for desi and (1:1) for dwarf. This, however, is subject to actual measurement on barani land.

Dwarf and Desi Wheat Yields

All farmers in the sample know the size of their cultivated acreage and measure grain that has been sun dried on the threshing floor with a *wodi* (a wooden or metal measuring bowl). Each farmer knows how much wheat, maize and rice weigh in his own wodi in terms of seers.[15]

In addition to counting the number of wodis of each harvested crop, barani smallholders seem capable of recalling production for at least three years. Customarily, they discuss production over the *hukka* (smoking pipe) in casual gatherings. Thus, the data appear to be reliable.

Table 4 gives comparative yields on a per acre basis between desi and dwarf wheat. It can be seen that each year dwarf wheats out-yielded desi wheats by a consistently wide margin. In 1967-68 both temperature and rainfall were within the range conducive to good yields with the dwarf wheats.

In subsequent years, dwarf wheats were grown on more and more acreage which apparently included a mix of factors resulting in reduced yields: (i) poorer land under dwarfs, (ii) poorer farm managers growing the new varieties, (iii) less ideal weather, and (iv) less fertilizer per acre on dwarfs. Yet, dwarf wheats continued to yield more than desi wheats in all periods.

Table 4. **Comparative Yields for Desi and Dwarf Wheat on Barani Land, Hazara District, West Pakistan.**

Year	Dwarf Wheat		Desi Wheat	
	Number of Growers	Yield Acre (mds)	Number of Growers	Yield Acre (mds)
1967-68	26	23.92	1[illegible]	9.08
1968-69	60	17.52	28	10.24
1969-70	98	15.12	62	8.48
3 Year Ave.	61	18.85	39	9.27

It was clearly evident to the respondents that dwarf yields are greater than desi yields. Respondents also claimed that there is less risk and more certainty in sowing dwarfs; they at least "got their seed back." On the other hand, farmers said that many times they had to feed their desi wheat as fodder to the animals and they "got no seed back."

THE IMPACT OF DWARF WHEAT

Major Issues

The degree to which barani smallholders have benefitted from dwarf wheats is a concern of policy makers.[16]

Technological change embodied in the dwarf wheats, together with the accompanying change in complementary inputs, has had a number of significant effects on both the economy and society of Lora and Oghi. Understandably, measuring the impact of new technology requires more extensive analysis:

(1) **Greater Cropping Intensity**[17] Respondents in Lora and Oghi are moving towards increased multiple cropping. Most of that move has been made possible by the introduction of dwarf wheats which mature earlier than desi varieties. The 1969-70 average cropping intensity index for Lora was 141 and for Oghi 103. By calculating the average acreage that respondents say they will sow during 1970-71 rabi period and by making the safe assumption that respondents will sow the same amount of maize during the following summers, Lora's cropping intensity will increase to 148, Oghi's to 110.

(2) **Increased Output** Barani smallholders are not only expanding planted acreage but they are getting higher yields, as noted above. For every given acre of land sown with dwarf wheats, farmers are harvesting at least seventy percent more than before. More mouths are being fed and less money is needed to purchase food grains. Money that is saved creates a capital-generating capacity in the people.

All who adopted dwarf varieties realized comparatively greater output per acre than those who did not use the new varieties. Even among those adopting dwarf wheats there is a noticeable difference in the changes in production between farmers; some are using fertilizers, others are not, some are getting exceptional yields and others less so, etc.

(3) **Increased Employment** Greater output requires more labor to harvest the total product. Mechanized harvesting for the present generation seems an impossibility on these hilly terraced farms.

Analysis of the additional man-hours employed with dwarf wheats as compared to desi wheat for each stage from field preparation through storage shows that overall labor requirements have increased by about 50 percent (Table 5). However, yields

15 One seer equals 2.087 lbs. or 1/40 of a maund. One maund equals 82.286 lbs. One *wodi* holds approximately 5-1/2 seers of wheat grain.

16 For a general statement of concern see Planning Commission, Government of Pakistan, *The Fourth Five Year Plan, 1970-75*, July 1970, p. 262.

17 Cropping Intensity

$$100 \frac{\text{Net area sown} + \text{Area sown more than once}}{\text{Net area sown}}$$

have increased by as much as 100 percent. In essence, there are notable economies with increased output which mean that the average cost per maund for processed dwarf wheat is less.

Table 5. Man-Hours Employed Per Acre for Wheat Production (Average of responses from 143 farmers for 1969-70 wheat crop).

Wheat	Field Preparation and Sowing	Harvesting	Clara[a] and Threshing	Winnowing and Storage	Total
1. Dwarf	96.8	74.4	40.8	40.0	252.0
2. Desi	62.4	52.0	28.0	26.4	168.8
3. Added Labor	34.4	22.4	12.8	13.6	83.2

a *Clara* is a threshing floor prepared by driving bullock teams in circles on a particular spot in the field until the ground is packed hard.

Wider Effects

The adoption of dwarf wheats appear to have additional important long term ramifications:

(i) **Increased awareness of changes in agriculture.** During many of my visits to Lora Oghi, farmers frequently approached me to ask where they could acquire new varieties of seed. Many could name some of the varieties they heard about over the radio. They are also acutely aware that changes can be made in their maize production as well, a crop which has been relatively untouched in barani areas by technological advances.

Furthermore, they are already aware of the government changes that affect complementary inputs. A recent announcement by the Ministry of Finance to tax fertilizer and hence, raise its price, brought loud outcries from the people of Lora and Oghi.

(ii) **Further demands on the Department of Agriculture and the Agricultural Development Corporation** to supply more information and cheaper inputs to boost agricultural production. Barani smallholders want to know what local level extension workers do and how they can be helpful and instructive in the ways of new technology. This also puts some pressure on Field Assistants, fertilizer distributors and others to keep informed about improved seeds, types and rates of fertilizer application, pesticides, sowing periods, etc., if they expect to be of more assistance to the farmers.

(iii) **Those using dwarf wheats who get good yields desire to pay cash instead of a proportion of the crop—as is usually done—for the services of moeens** (cobblers, blacksmiths, tailors, etc.). The movement is away from barter arrangements towards a cash economy. This is already taking place and the effect will be to create cash saving and investment opportunities for those who readily participate in the larger money economy.

SUMMARY

Barani smallholders have adopted dwarf varieties of wheat in a remarkably short time. Significant in diffusing the new technology were the many types of interpersonal and mass media communication channels which informed the farmers that dwarf wheats are higher yielding than desi wheats.

Interpersonal contacts between villagers created the most awareness. Of the mass media channels of communication, the radio was important in Hazara. In addition, demonstration plots on farmers' fields made it possible for the potential adopters to see the striking differences between desi and dwarf yields.

Technical and economic factors largely influenced the farmer to try dwarf wheats: (1) yields were consistently better with dwarfs, (2) the technology was relatively simple to understand and use, and (3) no major changes were required in the cropping pattern.

The primary effects of technological change with dwarf wheats at the farm level were: (1) to increase cropping intensity, (2) to increase output and, in concert, (3) to generate employment. Long term effects are becoming evident with increased social interaction between farmers and extension people and a greater move towards a money economy.

In sum, barani smallholders are highly responsive to significantly "better" innovations which are neutral to scale. They are equally responsive and reachable by mass media and interpersonal channels of communication.