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One of the major objectives of the on-going Precision Land Leveling Program, under the direction of the On-Farm Water Management Pilot Project, is to level small farmer holdings. Based upon an intense cross-sectional survey of 120 farmers in Punjab, this report demonstrates that the Precision Land Leveling Program has been largely unsuccessful in achieving this objective since its inception in 1976. The sampling was conducted in six major areas of on-farm water management activity in precision land leveling and watercourse improvement. Sixty (one-half) of the farmers sampled had had precision land leveling work done on their land and received a government subsidy in the process. The remaining 60 represented farmers who were aware of the program but chose not to participate. This report analyzes the degree to which "small" farmers participated in the program, and identifies and evaluates the main constraints on small farmer participation. The major benefits and costs of land leveling (both primary and secondary, direct and indirect, pecuniary and nonpecuniary) are identified and evaluated, although no attempt was made to put a monetary value on the benefits. Finally, the report makes several recommendations for improving the Precision Land Leveling Program, including methods to incorporate small farmers more extensively.

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**CONSTRAINTS ON
SMALL FARMERS IN THE
PRECISION LAND
LEVELING PROGRAM IN
THE PAKISTANI PUNJAB**

**By Raymond Z. H. Rentro
assisted by Muhammad
Iqbal Akhtar-Niazi
and Abdul Ghaffar**

**Water Management Research Project
Colorado State University
Fort Collins, Colorado
December, 1979**

**CONSTRAINTS ON SMALL FARMERS IN THE PRECISION LAND LEVELING
PROGRAM IN THE PAKISTANI PUNJAB**

WATER MANAGEMENT TECHNICAL REPORT NO. 54

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CONSTRAINTS ON SMALL FARMERS IN THE PRECISION LAND LEVELING
PROGRAM IN THE PAKISTANI PUNJAB

ABSTRACT

One of the major objectives of the on-going Precision Land Leveling Program, under the direction of the On-Farm Water Management Pilot Project, is to level small farmer holdings. Based upon an intense cross-sectional survey of 120 farmers in Punjab, this report demonstrates that the Precision Land Leveling Program has been largely unsuccessful in achieving this objective since its inception in 1976. The sampling was conducted in six major areas of on-farm water management activity in precision land leveling and watercourse improvement. Sixty (one-half) of the farmers sampled had had precision land leveling work done on their land and received a government subsidy in the process. The remaining 60 represented farmers who were aware of the program but chose not to participate. This report analyzes the degree to which "small" farmers participated in the program, and identifies and evaluates the main constraints on small farmer participation. The major benefits and costs of land leveling (both primary and secondary, direct and indirect, pecuniary and nonpecuniary) are identified and evaluated, although no attempt was made to put a monetary value on the benefits. It is demonstrated that there are major distinctions between the group of farmers who participated in the program and the group who was aware of the program but did not participate, with respect to farm size (ownership versus operational sizes), education level, degree of status and power in the village, degree of cash farming and market orientation, type of watercourse, land fragmentation, tractor and tubewell ownership, and way of hearing about the program. Finally, the report makes several recommendations for improving the Precision Land Leveling Program, including methods to incorporate small farmers more extensively.

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CONSTRAINTS ON SMALL FARMERS IN THE PRECISION LAND LEVELING
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Raymond Z. H. Renfro
assisted by
Muhammad Iqbal Akhtar Niazi, and Abdul Ghaffar¹

I. INTRODUCTION AND SCOPE OF WORK

In the fall of 1976 the current Precision Land Leveling (PLL) program, under the auspices of the On-Farm Water Management (OFWM) Development Project, began its operations in the Pakistani Punjab with the expressed purpose of aiding small farmers in the leveling of their fields to a precision of ± 2 cm. The assumption made by the project initiators was that by and large PLL could make fields more level and satisfy farmers to a higher degree than the leveling being done through the traditional method of the Krah and bullock. The On-Farm Water Management (OFWM) Directorate was established within the Ministry of Agriculture to carry out the PLL program. It was the goal of OFWM to reach the small farmers through a cost-sharing or subsidy program. Under this program farmers owning 25 acres or less are eligible to receive a Government of Pakistan subsidy of 50% on up to, but not exceeding, five acres precision leveled. The subsidy is based on the volume (measured in cubic meters) of earth moved, and not on the actual costs incurred. If a farmer owns, in his name, not more than 25 acres and precision levels more than five acres, he may receive a subsidy on only the first five acres leveled. Farmers owning in excess of 25 acres

¹/Graduate Research Assistant, Colorado State University, Department of Economics; Sociologist and Agronomist, Colorado State University Water Management Research Project, Pakistan, Field Staff, respectively.

are not eligible for the cost-sharing program, but may have their land leveled by a PLL team at full cost to the farmers. This PLL work is to be done by OFWM teams throughout the country (in Punjab, Sind and NWFP) in addition to their other major task of improving watercourses.

By mid-1978, at the latest, it became apparent that the project was not achieving all of its expressed goals, especially with regard to small farmers. The demand for precision land leveling often proved to exceed the supply of land-leveling teams and equipment in most (if not all) areas where the program was offered. There could be no doubt that OFWM was accomplishing one of its major goals; to level land in Pakistan. However, questions arose as to whether the program was adequately reaching the small farmer. This observation or "suspicion" was of major concern to many of those in USAID, the foreign exchange donors of this project, whose policy dictated that maximum efforts must be made to reach and benefit small farmers.

This study was initiated by Colorado State University (CSU) at the request of USAID with the intent of seeking out and evaluating whether the program was achieving its objective of leveling small-farmer holdings, as well as determining why those who were having PLL done and were eligible for the cost-sharing (subsidy) program were doing so.

By evaluating the reasons behind the decision of whether to have PLL work done or not, this study hopes to discover the degree to which small farmers have opted for PLL, and the reasons why or why not adoption has taken place. Emphasis was placed on the distinctions between small and very small farmers, and between ownership and operational

holdings, the major perceived benefits and costs of PLL,² the farmers' perceptions of the PLL teams and of the degree of OFWM participation in the PLL work, and any problems encountered or perceived in the subsidy program. The constraints were deemed to be best investigated by means of a field survey, consisting of farmer interviews. The final objective of this study is to offer suggestions to improve the project with regard to its expressed goals.

2/It was not the intent or expressed purpose of this study to conduct a benefit-cost analysis of PLL. Readers interested in benefit-cost studies of PLL may refer to:

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II. RESEARCH DESIGN AND METHODOLOGY

Since one of the major objectives of the PLL project is to aid the small farmer, special emphasis was given to the small farmer in the questionnaires.³ Out of a total sample size of 120, the design of the sampling was that all were to have been from small farmer populations. For the purposes of this study a small farmer is defined as one whose ownership land holding is not greater than 25 acres, in compliance with the Government of Pakistan's definition. This is also in accordance with the definition of a small farmer adopted by OFWM, insofar as eligibility for the cost-sharing program for PLL is concerned. However, it was felt necessary by the author to add the further distinction of "very small" farmer to those of the "small" and "large" farmers, whereby a very small farmer is one whose farm size (either in terms of ownership or operational size of holding) is less than 12.5 acres. In the view of most of CSU, SCS, and USAID members in Lahore and Islamabad consulted, a land holding of less than 12.5 acres could be adequately serviced by a one-bullock team, while holdings significantly in excess of 12.5 acres would necessitate the use of two or more bullock teams. Since the typical smaller farmer was viewed as owning only one bullock team, it follows that for this purpose an appropriate definition of a very small farmer is one who operates less than 12.5 acres.

Before proceeding further in this vein, it becomes necessary to digress briefly in order to explain the differences between ownership and operational size of holdings, and the significance of this

³/Copies of the questionnaires appear in Appendix B. Two distinct questionnaires were used; one for those who had had PLL done and received a subsidy; and the other for those who did not have PLL done but who were aware of the program.

distinction in Pakistan. Ownership size refers to the amount of land which is in the possession of a person, in his or her name only. The records of who owns what land are kept in the sub-district (Tehsil) courts as well as the district courts. Whereas we would expect that they are readily available through the local Patwaris (Revenue Department "tax-collectors") and through the land owners themselves, both farmers and OFWM personnel told us that this was not the case, and that reliable records of land ownership are often not readily available.

Operational size refers to the amount of land which is actually farmed by the individual concerned, which is more often than not in excess of ownership size. Land reform and land ceiling legislation in Pakistan heralded in an era of subdivision of land holdings in the names of sons, daughters, wives, and other family members in order to evade surrendering land to the government for redistribution--a practice that continues into the present. Add to this the prevalent custom of land holders in their final will and testaments to divide their lands among their sons, while only one or two brothers in a family commonly remain in the village and farm the land; and it becomes apparent why operational size usually exceeds ownership size. Quite simply, farmers are operating land beyond what they solely own in their names (i.e., in their brothers', sisters', sons', daughters', wives', etc., names), and are basing their incomes on the produce and rent of all or most of this land. If several brothers own land jointly, but only one or two brothers are actually farming the land, it is common for the non-farming brothers to receive a certain minimal share of the produce.

Also inclusive in the operational size category is any land that is rented-in (rented from others) for farming. It is possible for

ownership size to exceed operational size. Those landholders who allow their relations to farm and live off their land, or who rent out all or most of their land to others may have an operational size holding of zero, or at any rate considerably less than their ownership size holding. However, when interviewing farmers it is almost always the case that their operational size exceeds their ownership size. It is for this reason that what is commonly referred to as "farm size" is what this author has hereby defined as operational size. The distinction between ownership and operational size becomes very important when discussing whether a farmer is large, small or very small, and is repeatedly utilized in the ensuing discussion of precision land leveling.

Since operational size of holding is very difficult to ascertain and substantiate from farmers, government programs geared toward small farmers are usually based solely on ownership size. It is this author's observation, however, that even ownership size is very difficult to accurately ascertain due to the ease with which records can be manipulated. Because government policy pays attention only to ownership size, whenever farm size is discussed in the course of this paper both ownership and operational size distinctions will be presented. The hope is that by so doing both those who prefer to define farm size in terms of ownership and in terms of operational size will be satisfied.

Not only is the distinction between ownership and operational size of holding a matter of some controversy, but also a matter of considerable controversy is the definition of a small farmer in Pakistan. For the purposes of this study we have used the Government of Pakistan's definition of a small farmer as one who owns (in his name alone) 25 acres or less, and a large farmer as one who owns greater than 25 acres. The

"very small" category of less than 12.5 acres was added to attempt to obtain a higher degree of resolution within the small farmer category. It is by no means intended to address or dispel this controversy.

Since this study was to be completed in the relatively short period of three months (June-August, 1979), and also due to the fact that funds available for the hiring and training of researchers were limited, a sample size of only 120 was drawn. The effect of the annual monsoon on the logistics of traveling to villages and interviewing farmers was also a constraint on the sample size. The time and logistic support constraints did not allow the survey to include a sampling from the provinces of Sind and NWFP. The constraints on small farmers in PLL may very well differ between the provinces. The questionnaires were pretested during a week-long fact-finding trip in the areas where the PLL program was operating. Farmer responses elicited during this trip revealed the major reasons cited by farmers in all of the three farm-size categories for not having PLL done, as well as the major benefits and costs as perceived by those who had had PLL work done, and who participated in the cost-sharing program. This facilitated the formation of a final questionnaire which is shorter and more to-the-point than the pre-tested version. The confidence that the major constraints were being addressed in the survey also provided justification for utilizing a sample size of 120, with little or no sacrifice to reliability. It was hoped that a general trend-pattern would be adequately revealed by the chosen sample size, and the results showed this to be largely true.

PLL has been operating in eight major locations in the Punjab prior to October 1978, as reflected by the existence of eight OFWM Area Team Offices. Since October 1978 seven more OFWM Area Team Offices have

begun PLL work but these were viewed as being too recent in operation to be of effective use in this survey. At the time of this survey the current PLL program was only three years old which made adequate evaluation very difficult. Consequently, one of the major limitations of this study is that it is evaluating a program that has been in existence for a relatively short period.

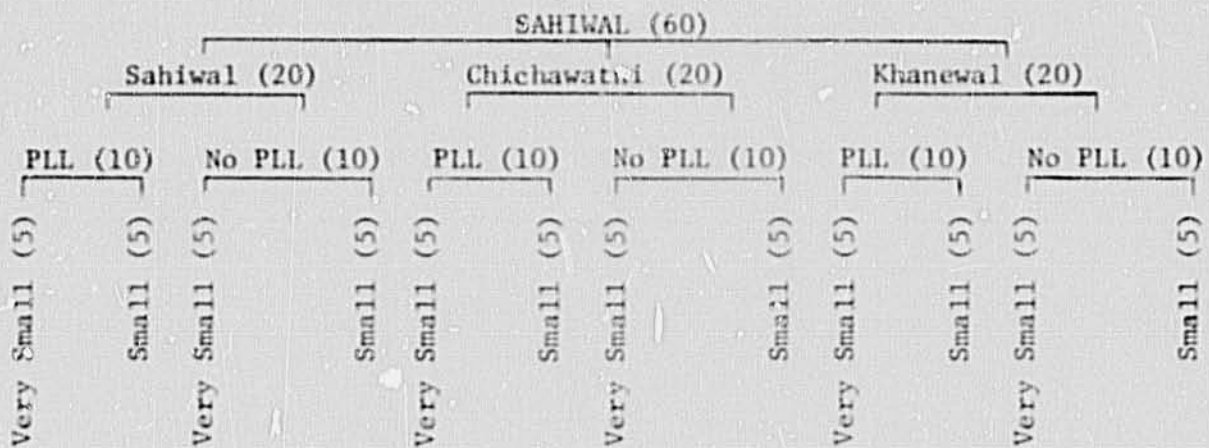
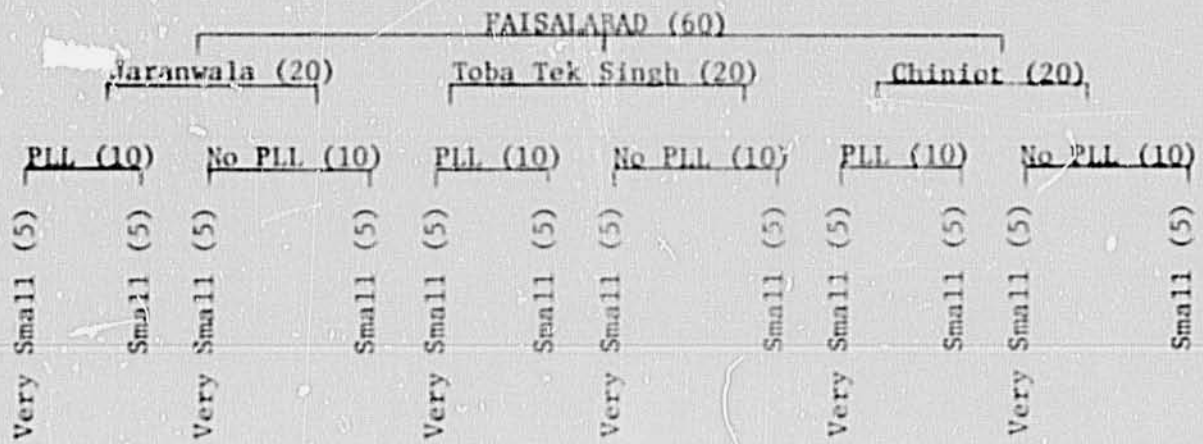
Of the eight "older" teams (those doing PLL prior to October 1978), five fall under the jurisdiction of the OFWM Coordinator Office (C.O.) in Faisalabad, and three are supervised by the OFWM Coordinator Office in Sahiwal. The five "older" Area Team Offices (A.T.O.) in the Faisalabad region are located in the Tehsil centers of Faisalabad, Jaranwala, Toba Tek Singh, Samundari, and Chiniot. All but the last are in the Faisalabad district of Punjab whereas Chiniot is in the Jhang district. The three "older" A.T.O.'s in the Sahiwal region are located in the Tehsil centers of Sahiwal, Chichawatni, and Khanewal. Sahiwal and Chichawatni are located in Sahiwal district and Khanewal is in Multan district.

Of the total sample size of 120, sixty were drawn in each of the Faisalabad and Sahiwal areas. This was done even with the awareness that more acres were being precision leveled in the area serviced by the Sahiwal C.O. than in all the areas serviced by the Faisalabad C.O. Since there are only three "older" area teams in the Sahiwal area, for the sake of even distribution of the sample, only three of the "older" area teams in the Faisalabad area were selected: Jaranwala, Toba Tek Singh, and Chiniot. Samples were not drawn from the immediate Faisalabad area since the influence of access of farmers in this area to the Agricultural University was not viewed as being typical of Punjabi farms. Samples were not drawn from the Samundri area because of its close proximity

to Toba Tek Singh, and it was felt that a sample from one of these areas was sufficient. In each of the six areas chosen for sampling, an equal number of those who had adopted PLL and of those who had not (No PLL) would be interviewed.

Since the primary objective of this study is to determine the major constraints of small farmers, no effort was made to draw a sample from larger farmers who were not eligible for participation in the cost-sharing program, i.e., those whose ownership size is greater than 25 acres, even though considerable PLL work has been done on farms within this category. However, it was to be expected that some farmers would be eligible for the subsidy, i.e., size of ownership is 25 acres or less, whose total operational size is greater than 25 acres. Likewise, no effort was made to include tenant farmers, since the fact-finding tour revealed that no tenant farmers were leveling land not in their own possession. The basis upon which the sample was selected is presented diagrammatically below (sample size is given in parentheses).

Random sampling took place only within the bottom line of categories of very small and small farmers. Sample farmers were selected from lists made available by the USAID Mission Office in Islamabad of all farmers who had PLL done and were eligible for a subsidy. The original lists are available in the OFWM Coordinator Offices in Faisalabad and Sahiwal. Selection of five very small and five small farmers from each of the six selected areas who did not have PLL work done had to be made as randomly as possible in the field, since no records were available for farmers in this category. The methods used in sample selection for both PLL and No PLL categories of farmers were as follows: (1) From the available lists, selection was made at random by assigning each farmer a number



and using a random numbers table. Five very small and five small farmers from each of the six PLL team areas were selected. If the person selected was not the farm operator but owner in name only, the operator was interviewed. If the person selected happened to be a female, an attempt was made to locate her husband or father for interview.³ (2) Three to five alternates were selected at random from the available lists, in the very small and small farmer categories, in case some of the farmers selected were not available. (3) Every attempt was made to search out

³/During the pretesting of the questionnaires it was apparent that it would be impractical to attempt to interview women. Pakistani villagers we encountered generally did not favor our inquiring about village women whom we wished to interview, especially if the women concerned practiced purdah. Apparently none of the women included in the OFWM lists actually farmed the land.

and interview as randomly as possible five very small and five small farmers from each area who had not had any PLL work by selecting neighbors of farmers who had PLL done. Whenever possible, when a very small (small) PLL farmer was interviewed, a very small (small) No PLL farmer who was aware of the program and in the same village or chak was also interviewed.

Through mid-1978 there was a total of 682 farmers in the six areas concerned who had had PLL done and were eligible for a subsidy (Jaranwala 96, Chiniot 81, Toba Tek Singh 101, Sahiwal 162, Chichawatni 78, and Khanewal 164). Out of these 682, 60 were selected for interviewing, or about 9% of the total.

Data obtained by Dr. S. Plunkett of USAID for the author from the National Fertilizer Corporation of Pakistan indicate that there are approximately 242,850 farms in the six areas where our sampling occurred. Of these, about 102,240 were farms completely owned (42%), 65,840 were operated by owner-cum-tenants (27%), and another 74,768 by tenants (31%). Our sampling of No PLL farmers only included those in the "pure" ownership category (since no tenant or tenant-cum-owner farmers were surveyed), and mainly those in the very small and small farm-size categories. More importantly, the specific population of No PLL farmers is only those who are aware of PLL for which, more importantly, overall data is, of course, unavailable. According to the same NFC data, some 95,248 farms (or 93%) in the "pure" ownership category were below 25 acres in size, while 6,995 (or 7%) were above 25 acres. Out of these 95,248 farms, 60 were selected for interviewing in the No PLL category of farmers, or less than 0.1% of the total farm population. This census NFC data is, of course, highly suspect and may be taken only as a very rough estimate,

but it does nevertheless, illustrate that the sample population from which the No PLL sample farmers were drawn is very large, and that our sampling of No PLL farmers is, statistically speaking, much less reliable than our sampling of PLL farmers.

DATA COLLECTION

Whenever possible, the above method of sample selection was followed in the field. Extensive use was made of the lists of randomly selected PLL alternates, since in all areas the lists of the first ten farmers to be interviewed were exhausted with many of these farmers not being located. Seeking out and interviewing No PLL farmers proved to be a relatively easy task as compared to locating and interviewing the PLL farmers from our selection lists. This was because No PLL farmers were relatively more abundant than PLL farmers, and because many of the PLL farmers on our lists simply could not be located.

The English questionnaires were translated into Urdu (copies of which are not included in this report, but which may be obtained upon request from the author) in order that the author's two research assistants could fully understand the nature of the questions being asked and the types of answers given. Considerable time was spent in developing the techniques needed for the interviewing. The Urdu translation of the questionnaires helped clarify exactly what questions were being asked, even though almost all of the interviews were conducted in colloquial Punjabi. The pre-testing revealed the types of answers that farmers tended to give to the questions asked. It became obvious at an early stage that some of the questions being asked were "leading" in nature. It was decided that the answers to these types of questions were generally unreliable and therefore they should not be used. For example, in the

pre-test questionnaire we asked farmers what benefits they realized from PLL, and in so doing proceeded to present a long list of benefits which we thought were important benefits from PLL to the farmer. In response to this list farmers quickly said that they had experienced all the benefits cited. We were then faced with the dilemma of deciding which benefits they, in fact, realized and to what degree these were important.

In order to avoid leading questions, we attempted to get farmers to elicit responses in their own words. Through the use of an interviewing technique loosely called "probing," we were able to take a farmer's initial response to a question and explore it further, verifying whether it was a truthful response, whether there was more to the answer than at first elicited, the degree of importance of the response, etc. Occasionally, during the course of an interview, a farmer would contradict an earlier statement, and verification of the correct response was then made. The questions relating to ownership and operational size, degree of cash farming (percentage of crops sold or traded), degree of market orientation, water supply, type of watercourses, land fragmentation, reasons for not doing PLL (No PLL farmers only), and benefits, costs, and degree of OFWM participation in PLL work (PLL farmers only) were probed in detail to insure accuracy. Because probing became so much a part of the process, each interview presented the interviewer with a new set of problems and challenges. While the average time for an interview was one hour, some interviews took considerably more time based upon the degree of difficulty in eliciting responses and verifying them. Every effort was made to accommodate the farmers and to allow them a free expression of ideas, and to not in any way pressure or embarrass them during the course of an interview. However time consuming,

it was felt that this paid great dividends in terms of reliability of data. We found that most farmers were more interested in talking about the improvement of their watercourses than about PLL, and as a result we often had to listen to complaints about watercourses and field farmers' inquiries in this regard to the best of our abilities prior to or in the course of any discussion about PLL. The authors are of the opinion that because we were by and large independent of any government organization (Pakistani or American), and because we impressed this fact upon the farmers that we met, we were, in all likelihood, more successful in eliciting accurate farmer responses than if we had been representatives of any government branch.

Random selection of farmers who had had PLL was made on the basis of the lists made available from OFWM. These lists contained the farmers' names, village, or chak numbers or names, total acres owned (based in the beginning on official, patwari-approved records, but later sheerly on individual farmer responses and testimony), total acres precision leveled, total acres cost-shared, date PLL work was completed, and the volume (m^3) of earth moved. Since all farmers on these lists had supposedly received a governmental subsidy, it follows that they were all owners of not more than 25 acres. However, during interviews we found numerous discrepancies between what the OFWM records told us and what the farmer told us, as demonstrated in Table 1. Based upon the OFWM records we selected a total of 30 very small PLL farmers to interview and 30 small PLL farmers. However, based upon farmer responses, there were only 17 farmers in the very small category, 29 in the small category, and a surprising 14 farmers in the large category. According to farmer responses, some 23% of the total interviewed were

Table 1. Number of farmers sampled in very small, small and large farm size categories.

	PLL									No PLL					
	Ownership ¹ (Farmer)			Ownership ² (OFWM)			Operational ³ (Farmer)			Ownership ¹ (Farmer)			Operational ³ (Farmer)		
	V.Sm.	Sm.	Lg.	V.Sm.	Sm.	Lg.	V.Sm.	Sm.	Lg.	V.Sm.	Sm.	Lg.	V.Sm.	Sm.	Lg.
Jaranwala	3	6	1	5	5	0	2	3	5	5	5	0	4	3	3
Toba Tek Singh	3	3	4	5	5	0	0	0	10	5	4	1	2	4	4
Chiniot	3	6	1	5	5	0	1	6	3	5	5	0	2	6	2
Total Faisalabad	9	15	6	15	15	0	3	9	18	15	14	1	8	13	9
Sahiwal	5	4	1	5	5	0	1	4	5	5	5	0	5	5	0
Chichawatni	3	5	2	5	5	0	0	4	6	5	3	2	3	3	4
Khanewal	0	5	5	5	5	0	0	2	8	5	5	0	4	3	3
Total Sahiwal	8	14	8	15	15	0	1	10	19	15	13	2	12	11	7
Total Farmer	17	29	14	30	30	0	4	19	37	30	27	3	20	24	16

1/Ownership category according to information given to authors by farmer.

2/Ownership category according to OFWM records.

3/Operational category according to information given to authors by farmer.

ineligible for participation in the cost-sharing scheme, but had nevertheless participated. It became apparent that these discrepancies must be due to one or more of the following: (1) farmers misrepresenting information to us and telling OFWM the truth; (2) farmers misreporting to OFWM and telling us the truth; (3) farmers misreporting to both of us and concealing the truth; (4) farmers truly did not know their degree of land ownership, and anything they said was unreliable; or (5) OFWM was misreporting information on their records. We did not make extensive efforts to pursue this issue by asking the farmers why what they told us and what the OFWM records said were in disagreement, as we were reluctant to challenge or embarrass the farmers. We felt this would hinder the accurate and easy completion of the interview. We did not attempt to settle this issue, because this would then raise the farmers' suspicions that perhaps we really were OFWM representatives, since we obviously had access to their records, and were lying to them earlier in our assertions that we were not government representatives. Due to our confidence in the "probing" technique, we felt it very unlikely that farmers were misreporting to us to any great extent. It is for this reason that whenever we refer in the report to ownership size, we are referring to only what the farmers told us, and not to what the OFWM records indicate.

It was our intention to interview a total of 30 very small No PLL farmers and 30 small No PLL farmers, but as Table 1 shows, we did interview three large No PLL farmers. This was because of their close proximity to certain PLL farmers interviewed and because of their rather well-informed awareness of the PLL program.

In terms of operational size categories, Table 1 reveals that we interviewed a total of only four very small PLL farmers, 19 small PLL

farmers, and a remarkable 37 large PLL farmers. Of the total of 60 No PLL farmers interviewed, 20 were very small, 24 small, and 16 large in terms of operational size.

It should be realized that any comparisons made in this study between PLL and No PLL farmers may tend to be biased, since we found that the sample of PLL farmers have larger farms than the OFWM records indicate, while the No PLL farmers selected are actually smaller farmers. Therefore, when comparison is made between the education levels (or any other factor) of PLL and No PLL farmers, we are to some degree comparing the education levels of larger versus smaller farmers. If earlier recognition of this discrepancy between the acres owned as told to us by farmers and what the OFWM records indicated had been possible, this problem could have been corrected by interviewing a No PLL farmer in the identical ownership size categorization of any PLL farmer interviewed. Since the problem was not recognized at an early stage, we were unable to adequately correct for this, and many of the tables presented reflect this bias, or "skewness" of the sample.

HYPOTHESES TESTED BY THE QUESTIONNAIRES

In designing the questionnaires we hoped to adequately test the following three major groups of hypotheses.

Farm Size and Farmer Categorizations

1. Larger farmers, both in terms of ownership and operational size, get more PLL done and thus collect more subsidy than smaller farmers. In fact, the sampling design does not permit a rigorous test of this hypothesis but several important related results were evident.

2. Ownership size varies greatly from operational size in general, and considerably more so when dealing with PLL farmers than with No PLL farmers.

3. PLL farmers generally have more formal education than No PLL farmers.

4. PLL farmers are generally more likely to be located on improved watercourses than unimproved watercourses, and in this way have easier access to OFWM information and personnel. Also, larger PLL farmers tend to be located more on improved watercourses, and smaller PLL farmers on unimproved watercourses.

5. PLL farmers are more likely to be on improved watercourses than No PLL farmers.

6. No PLL farmers generally have more fragmentation of land holding than PLL farmers.

7. PLL parcels (location sites) are generally more prevalent at the tail of any watercourse, where water is in scarcer supply.

8. PLL farmers generally sell or trade more cash crops than No PLL farmers; i.e., No PLL farmers are more likely to be subsistence farmers.

9. PLL farmers are generally more part-time farmers than No PLL farmers.

10. PLL farmers are less dependent on the farm as their sole source of income than No PLL farmers.

11. PLL farmers generally own their own tractors and No PLL farmers do not generally own tractors.

12. PLL farmers are more likely to own tubewells than No PLL farmers.

13. PLL farmers generally have a perceived lack of water, and for this reason desire PLL; No PLL farmers feel they have sufficient quantities of water.

Impact of the PLL Program

14. PLL farmers come into contact with the PLL program in different ways than No PLL Farmers. Also, larger farmers come into contact with the PLL program in different ways than do smaller farmers.

15. There are differences between the arrangements made by the farmers and OFWM to do the PLL work and the actual degree of OFWM participation.

16. There are different ways in which OFWM actually participates with a farmer in PLL. These differences are somehow related to farm size, education levels, and tractor ownership.

17. There are different numbers and types of equipment and implements used for PLL. Bullocks and krah are used often. The source of these implements is widely variant.

18. The number of days between when the arrangements for PLL were made and when the work actually started is somehow related to farm size.

19. The duration of the PLL work is somehow related to farm size, the OFWM Coordinator Office concerned, the number of acres precision leveled, and tractor ownership.

20. The benefits of PLL are generally related to saving water and increasing production and yield.

21. The expected benefits of PLL match the benefits actually experienced after PLL.

22. The total (direct plus indirect) costs of PLL exceed the direct costs (costs related solely to the PLL work in the field), i.e., indirect costs are a substantial amount.

23. The subsidy is approximately half of the total cost of PLL (as designed to be).

24. The most troublesome (significant) costs of PLL are those of tractor operation and/or tractor rental.

25. Farmers who have had PLL are anxious to get more, unless all of their land has already been precision leveled.

Constraints on Farmers in the PLL Program

26. No PLL farmers are aware of the program but have not attempted to participate in the program.

27. The reasons given for not doing PLL are related to farm size, degree of cash farming (percentage of crops sold or traded), education level, type of watercourse, tractor ownership, and the percentage of water needs met in both cropping seasons.

28. The source of future PLL (hypothetical question) is different for PLL and No PLL farmers.

29. There are no easy credit arrangements available for PLL.

30. OFWM personnel visit PLL farmers within one year of the PLL work and inspect the fields precision leveled.

MODE OF ANALYSIS

To examine and test each of the above hypotheses, tables have been constructed, and are presented and discussed below. The table on size of holdings consists of mean and/or median values, based solely on farmer responses to the interviewers. The remaining tables consist of listings of numbers (frequency counts) and percentages. Where percentages are reported they are usually "corner" percentages, i.e., percentages calculated based upon a presentation of the total number of responses. However, when breakdowns according to OFWM C.O.s are presented the percentages are calculated as percent of total within C.O. area (Faisalabad or Sahiwal).

A statistical chi-square test of significance was then run on each table, with the help of the desk-top Hewlett-Packard, Model 9825A computer at the CSU/USAID office in Lahore. The general formula for using the chi-square test of significance (in analysis of counts or frequencies) is:

$$\chi^2 = \sum \frac{(Ob-Ex)^2}{Ex}$$

where Ob is the observed value for each of two or more classes and Ex is the corresponding expected value. In this study both two and three (two-way and three-way tests) classes were analyzed. For those cases having only 1 degree of freedom a correction factor was used called the Yates Correction for Continuity. Where appropriate, main effects were tested assuming that the expected values would be equally distributed within classes. For two-way interactions the expected values were calculated by the formula:

$$Ex = \frac{RC}{T}$$

where R, C, and T are the row, column, and total sums respectively.⁴ Unfortunately, no examples of three-way interaction tests were found in the references cited in the footnote below. Therefore, the expected values of three-way interactions had to be devised and experimented with. The formula used for calculation of these expected values was:

$$Ex = \frac{\sum_{i=1}^{n_i} Y_{ijk} \sum_{j=1}^{n_j} Y_{ijk} \sum_{k=1}^{n_k} Y_{ijk}}{\sum_{i=1}^{n_i} \sum_{j=1}^{n_j} Y_{ijk} \sum_{i=1}^{n_i} \sum_{k=1}^{n_k} Y_{ijk} \sum_{j=1}^{n_j} \sum_{k=1}^{n_k} Y_{ijk}} (T)$$

⁴/Little and Hills, *Statistical Methods in Agricultural Research*, University of California, Davis, 1972. Chapter XVII.
Snedecor and Cochran, *Statistical Methods*, 6th Edition, Iowa State University Press, 1967, pp. 20-26, 209-212, 215-220, 236-240.

where Y_{ijk} represents the cell for which the expected values are to be calculated, n_i , n_j and n_k are the levels of factors i , j and k , respectively, and T is again the sum of all observations. With regard to both two-way and three-way interactions, in cases where there are cells in a table that have values of zero, or near zero (i.e., less than five), the chi-square tests become less rigorous and more of an approximation.

III. RESULTS AND DISCUSSION

FARM SIZE AND FARMER CATEGORIZATIONS

Before initiating a general discussion of the effects of the PLL program on farmers, it will prove useful to highlight some of the major characteristics and distinctions between those farmers who have had PLL work done and received a subsidy (hereafter abbreviated as "PLL") and those farmers who did not have PLL done but were aware of the program ("No PLL").

The first hypothesis made in the course of this study was that larger farmers, both in terms of ownership and operational size, are more likely to have PLL done than smaller farmers. The original design of this study would not provide for a direct test of this hypothesis, particularly in the case of ownership, as the sample was stratified according to farm ownership size. However, interactions between PLL, farm size, and other factors such as education, are of considerable interest. The second hypothesis made was that ownership size varies greatly from operational size in general, and considerably more so when dealing with PLL farmers than with No PLL farmers. The second hypothesis was based upon the assumption that there was more incentive for PLL farmers to subdivide their land holdings among many land-owning relatives in order to more effectively avoid land ceiling legislations and to take advantage of government cost-sharing programs aimed at "small" farmers (including the PLL program).

Table 2 addresses these two hypotheses. This table reveals several points of interest. There is a noticeable difference between the mean and median farm sizes of PLL and No PLL farmers. The mean acres owned by PLL farmers (25.9) is slightly less than twice the mean acres owned by No PLL farmers (14.5). Median ownership values, however, show little

Table 2. Mean and median acres--owned vs. operated (PLL vs. No PLL) and percentage difference.¹

	PLL						No PLL					
	Mean owned	Mean op.	% Diff.	Med- ian owned	Med- ian op.	% Diff.	Mean owned	Mean op.	% Diff.	Med- ian owned	Med ian op.	% Diff.
Jaranwala	19.4	40.1	107	17.9	28.3	58	12.8	24.7	93	11.3	16.5	45
Toba Tek Singh	21.4	82.4	285	18.0	60.0	233	23.4	45.0	93	12.3	20.3	65
Chiniot	18.8	52.4	179	14.3	16.8	17	10.6	17.0	60	11.0	16.3	48
Total Faisalabad	19.8	58.3	194	16.5	28.5	73	15.6	28.9	85	12.3	18.0	46
Sahiwal	22.4	57.0	154	12.0	33.5	179	11.2	12.8	14	10.3	10.3	0
Chichawatni	17.4	257.4	1380	17.8	43.8	146	16.8	36.4	116	12.0	20.0	67
Khanewal	55.8	129.9	133	37.5	111.2	197	12.0	28.7	139	12.0	14.0	19
Total Sahiwal	31.9	148.1	364	15.0	51.3	242	13.4	26.0	94	12.0	14.0	17
Total Farmers	25.9	103.2	299	12.5	43.8	183	14.5	27.4	89	12.5	16.0	28

¹/Percentage difference is defined as operated area minus owned area, divided by owned area and multiplied by 100.

variation (15.5 for PLL and 12.5 for No PLL). The contrast in mean and median values illustrates that the mean values are being influenced by a few very large farms. It should be remembered that this is not, in fact, a test of farm size as related to whether or not the farmer was likely to have PLL performed, as the samples were selected by farm size. It is instead a confirmation of a somewhat different hypothesis, that farmers report larger ownership to an independent investigator than is reflected on the OFWM records for PLL.

When looking at operated values, the contrast becomes more striking: the value of mean acres operated is over four times as great for PLL farmers than for No PLL farmers. Median operational values reveal that PLL farmers operated approximately three times greater area than No PLL farmers. These contrasts between PLL and No PLL farmers are more distinct and variant in the Sahiwal area in comparison to the Faisalabad area. It should be remembered that the mean and median values given here for No PLL farmers are by no means representative of all No PLL farmers. For one thing, the No PLL farmers were not ideally randomly selected, and for another, we stratified our sampling by choosing half of the No PLL sample from the very small and half from the small farm size categories.

In fact, according to the same NFC data cited earlier in this report, some 87% of all farms controlled by "pure" owners in the Jaranwala area are in the very small category, 11% in the small category and only 2% in the large category. However, since very little is known about the collection of the data, it is highly possible that these are also susceptible to under-reporting or artificial division of land. In Toba Tek Singh we find 78% in the very small category, 15% in the small category and 7% in the large category. In Chiriot, there are 64% very small, 20% small and 16% large. In the combined areas of Sahiwal and Chichawatni,

there are 80% very small, 14% small and 6% large. In Khanewal, there are 78% very small, 17% small and 5% large. If we consider all farm categories in these areas (owners, owner-cum-tenants, and tenant farmers) we find for Jaranwala: 76% very small, 19% small and 5% large; Toba Tek Singh: 68% very small, 23% small and 8% large; Chiniot: 59% very small, 28% small and 14% large; Sahiwal-Chichawatni: 64% very small, 26% small and 9% large; Khanewal: 68% very small, 24% small and 7% large.

Table 2 also reveals the sharp contrast between acres owned and acres operated as reported to us by farmers. The percentage difference reported by all farmers between mean acres owned and mean acres operated for PLL farmers was nearly 300%, whereas it was less than 100% for No PLL farmers. Likewise, the percentage difference between median acres owned and operated for PLL farmers was approximately 200%, whereas it was only 28% for No PLL farmers. Within the category of PLL farmers, the percentage differences were most striking in the A.T.O.'s (or tehsils) of Toba Tek Singh, Khanewal, Chichawatni, and Sahiwal, and were least divergent in Chiniot and Jaranwala.

Although it is difficult to draw too many conclusions from this table, it is apparent that there are relatively large farmers doing PLL (and receiving a subsidy) in the areas of Khanewal, Toba Tek Singh, Chichawatni, and Sahiwal. Looking at median values, which are perhaps more reliable and/or more representative than mean values, we see that out of all the A.T.O.'s only the PLL farmers in Sahiwal fall into the very small category for ownership size, and that the PLL farmers in Khanewal may be categorized as large farmers (with a median ownership value of 37.5 acres). When looking at median operational sizes for PLL farmers, we see that farmers in all tehsils or A.T.O. areas, with the

exception of Chiniot, fall into the large category. Khanewal PLL farmers may even be termed "very large" with regard to median operational size (with a median operated area of 111.2 acres).

It was noted earlier that numerous discrepancies were found between the information on acres owned that the OFWM records indicated and what the farmers told us. There were also noticeable discrepancies between what the OFWM records indicated and what farmers told us in regard to the number of acres precision leveled. These discrepancies between the OFWM records and farmers-informants with regard to both acres owned and PLL acreages are demonstrated in Table 3 with the use of mean values. With regard to acres owned, Table 3 illustrates that for all PLL farmers surveyed there was a discrepancy of 95% between what farmers told us and what the OFWM records reported. In other words, farmers told us that they owned almost twice as many acres as the OFWM records indicate. This discrepancy is most noticeable in the Khanewal area (360% difference), and least noticeable in the Toba Tek Singh area (15% difference).

With regard to acres precision leveled, there were noticeably fewer discrepancies between the OFWM records and what farmers reported to us. Overall, there was only a 46% difference, or, in other words, what farmers told us was only half as much in excess of what the OFWM record indicated. However, there were high discrepancies in the Khanewal and Chiniot areas, no doubt in part due to the farmer's tendency to report to us all the acres precision leveled in terms of his operated, and not sheer ownership, holding size. Attempts to correct for this, both through the probing technique when interviewing farmers and by summing PLL acreages of joint family members from OFWM records-lists, were not always successful.

**Table 3. Mean acres owned (PLL only) and mean PLL acreages.
(Farmer vs. OFWM, and percentage difference*)**

	Mean acres owned (PLL only)			Mean PLL acreages ²		
	Farmer ¹	OFWM ¹	Difference	Farmer ³	OFWM ⁴	Difference
Jaranwala	19.4	11.4	71	5.1	4.4	17
Toba Tek Singh	21.4	18.6	15	11.6	14.3	-19
Chiniot	18.8	12.1	55	6.7	3.4	96
Total						
Faisalabad	19.8	14.0	42	7.8	7.4	6
Sahiwal	22.4	12.2	83	5.7	4.4	30
Chichawatni	17.6	13.1	33	6.3	4.9	29
Khanewal	55.8	12.1	360	18.0	5.1	253
Total						
Sahiwal	31.9	12.5	155	10.0	4.8	109
Total						
Farmers	25.9	13.2	95	8.9	6.1	46

*% difference is defined as Farmer minus OFWM, divided by OFWM, multiplied by 100.

1/Mean ownership area according to information given to authors by farmers.

2/Mean ownership area according to OFWM records.

3/Mean acres precision leveled according to information give to authors by farmers.

4/Mean acres precision leveled according to OFWM records.

The third hypothesis developed in the course of this study was that PLL farmers are generally more (better) educated than No PLL farmers.⁵ To determine this, farmers were asked at what level they had stopped their education. Three major categories were utilized: none (no formal education at all), Primary plus Matric (spanning grades 1-10, and inclusive of passing the Matriculate exam), and Above Matric (including the F.A., Bachelor and Masters levels). The results are presented in Table 4. The table is, in fact, a four-way analysis demonstrating the effects of PLL vs. No PLL farmers, education levels, ownership size categories, and operational size categories. Both two- and three-way chi-square tests of significance were run in order to demonstrate the various effects which variables in the table have upon each other. The results of the chi-square tests are presented below the table in terms of the variables upon which the test was run, the resultant chi-square (χ^2) value, the number of degrees of freedom (df), and the level of significance (s.l.). Only those s.l. values of 0.1, 0.05, 0.01 and 0.001 were treated as being significant. Those values (and tested variables) not viewed as significant are so indicated by the symbol "NS" in parenthesis.

Chi-square tests on the data in Table 4 read that PLL and No PLL farmers vary with respect to ownership and operational size categories at the 5% and 0.1% significance levels respectively. This, more or less, verifies the results presented in Table 2 on mean and median farm size.

⁵Only formal education was considered, even though it was recognized that there are other measures of education, especially with regard to agriculture. Among these are knowledge of cropping and agronomic techniques, knowledge and utilization of more modern technologies, etc., which may better serve as measures of a farmer's degree of "progressiveness." Unfortunately, we failed to take into account the aspects of informal education in the course of the survey which would have enabled another and perhaps more accurate evaluation of progressiveness.

Table 4. Education and farm size (PLL vs No. PLL) - number of farmers.

	None (0)	Primary +	Above metric	Total	None (0)	Primary +	Above metric	Total
<u>Ownership size</u>								
Very small	3	10	4	17	13	14	3	30
Small	6	17	10	33	7	19	1	27
Large	1	5	4	10	0	3	0	3
Total farmers	10	32	18	60	20	36	4	60
<u>Operational size</u>								
Very small	1	1	2	4	11	8	1	20
Small	5	10	4	19	6	16	1	23
Large	4	21	12	37	3	12	2	17
Total farmers	10	32	18	60	20	36	4	60
PLL/No PLL vs. Ownership size:				$\chi^2 = 7.965$	2df	s. l. = .05		
PLL/No PLL vs. Operational size:				$\chi^2 = 18.455$	2df	s. l. = .001		
PLL/No PLL vs. Education:				$\chi^2 = 12.478$	2df	s. l. = .01		
Ownership size vs. Education:				$\chi^2 = 5.194$	4df	s. l. = .50(NS)		
Operational size vs. Education:				$\chi^2 = 14.191$	4df	s. l. = .01		
PLL/No PLL vs. Ownership size vs. Education:				$\chi^2 = 5.188$	4df	s. l. = .50(NS)		
PLL/No PLL vs. Operational size vs. Education:				$\chi^2 = 5.146$	4df	s. l. = .50(NS)		

The PLL and No PLL farmers are also shown to differ with respect to education at the 1% level of significance. There were approximately an equal number of PLL and No PLL farmers in the Primary plus Matric category, but there were significantly more PLL farmers in the Above Matric category as compared to No PLL farmers; and significantly less PLL farmers in the None (no education) category. There was no significant relationship demonstrated between education and ownership size, but education was related to operational size at the 1% level. This indicates that when looking at operational size of holding, large farmers (both PLL and No PLL) tend to be more educated than small and very small farmers, and that very small farmers tend to be relatively less educated as compared to small and large farmers. Analysis of the three-way relationships (between PLL/No PLL, ownership size, and education, and between PLL/No PLL, operation size, and education) revealed nothing of significance. Whereas there was a significant relationship between education and operational size for all farmers, there was nothing of significance when this test was extended to include the distinction between PLL and No PLL farmers.

As was pointed out earlier at the end of the Data Collection section, there is a problem of bias or skewness of the sample with comparison between PLL and No PLL farmers. Consequently, the higher education level of PLL farmers reflected in Table 4 can be largely explained by the larger farm size of PLL farmers. If smaller (larger) PLL farmers were better educated than smaller (larger) No PLL farmers, then we would expect significance in the three-way interactions. Because there was no significance shown in the three-way interactions, we are unable to say that smaller (larger) PLL farmers are better educated than smaller (larger) No PLL farmers.

In summary, PLL farmers were demonstrated to be better educated than No PLL farmers. However, larger farmers in general were shown to be better educated than small farmers, and we could not demonstrate that PLL farmers at the same farm size were better educated than No PLL farmers (three-way interaction).

The fourth hypothesis of this study speculated that PLL farmers are generally located more on improved than on unimproved watercourses, and in this way more readily come into contact with OFWM personnel who are the ones improving the watercourses and who can inform the farmers about the PLL program. Also, the hypothesis was that it is large PLL farmers who tend to be on improved watercourses (IWC), whereas very small PLL farmers tend to be on unimproved watercourses (UIWC).

The results, as presented in Table 5 effectively refute the hypotheses that PLL farmers are generally located more on improved than on unimproved watercourses and that it is large PLL farmers who tend to be on improved watercourses, whereas very small PLL farmers tend to be on unimproved watercourses. However, Table 6 reveals that there is more of a tendency for farmers on improved watercourses to do PLL than is apparent from the sheer distribution of land on unimproved versus improved watercourses. It was found that 63% (or approximately two-thirds) of all PLL farmers were found to have their land on unimproved watercourses. This would seem to suggest that farmers were more inspired to do PLL based upon other considerations than mere presence of land on an improved watercourse. However, this information only refutes the hypothesis that PLL farmers tend to be located more on improved than unimproved watercourses, but it does not effectively address the question of whether leveled parcels tend to be more on improved or unimproved watercourses.

Table 5. Number of farmers with regard to type of watercourse and farm size (PLL only)--corner percentages.

	Improved Watercourse		Unimproved Watercourse		Total	
	No	(%)	No	(%)	No	(%)
<u>Ownership Size</u>						
Very small	8	(15)	9	(17)	17	(33)
Small	9	(17)	17	(33)	26	(50)
Large	<u>2</u>	<u>(4)</u>	<u>7</u>	<u>(13)</u>	<u>9</u>	<u>(17)</u>
Total	19	(37)	33	(63)	52	(100)
<u>Operational Size</u>						
Very small	3	(6)	1	(2)	4	(8)
Small	9	(17)	7	(13)	16	(31)
Large	<u>7</u>	<u>(13)</u>	<u>25</u>	<u>(43)</u>	<u>32</u>	<u>(62)</u>
Total	19	(37)	33	(63)	52	(100)
Ownership Size vs. IWC/UIWC: $\chi^2 = 1.648$ 2 df s.l. = 0.50 (NS)						
Operational Size vs. IWC/UIWC: $\chi^2 = 8.2$ 2 df s.l. = 0.05						

Table 6. Number of watercourses in the 60 villages surveyed and number of precision leveled parcels with regard to type of watercourse--row percentages.

<u>Total Watercourses in Villages</u>						<u>Total Precision Leveled Parcels</u>					
<u>IWC</u>		<u>UIWC</u>		<u>Total</u>		<u>IWC</u>		<u>UIWC</u>		<u>Total</u>	
No	(%)	No	(%)	No	(%)	No	(%)	No	(%)	No	(%)
39	(21)	143	(79)	182	(100)	26	(37)	45	(63)	71	(100)
Expected number of parcels on IWC: (.21)(71) = 15 parcels						Expected number of parcels on UIWC: (.79)(71) = 56 parcels					
expected vs. actual number of parcels (IWC/UIWC): $\chi^2 = 9.26$ 1 df/s.l. = 0.01											

This question touches on a much broader controversy prevalent in discussions of OFWM in Pakistan, and the relationship between PLL and the improvement of watercourses. One argument is that the two programs of PLL and improving watercourses are competitive with each other, in the sense that both represent techniques of saving relatively scarce supplies of water; and that farmers are somewhat "irrational" to invest in the costly and capital-intensive PLL work if they are located on improved watercourses, where they are supposedly saving more canal water in comparison to a farmer on unimproved watercourses. The argument follows that those farmers on unimproved watercourses are not realizing any of the benefits of an improved watercourse and therefore are more inclined to do PLL in order to realize a saving and better utilization of their given water supplies. The counter-argument to this is that the two programs are, in fact, complementary and that farmers will first seek to improve their watercourses and then go about doing PLL in order to further their benefits with regard to water utilization and crop production.

Table 6 represents an attempt to analyze this controversy by comparing the expected number of parcels to the actual number with respect to type of watercourse. From the data collected on the total number and percent of watercourses (improved and unimproved) in the 60 villages visited, it was assumed that these percentages corresponded very closely to the number of parcels present on the different types of watercourses. Using these percentages and data on the total number of leveled parcels, the expected number of parcels on IWC's and UIWC's were calculated. The chi-square test compared these expected values to the actual observed number of leveled parcels. Another assumption made was that the size of the parcels was not significantly different between leveled and un-leveled parcels. The chi-square test revealed a significance at the

1% level, indicating that leveled parcels are more likely to be on improved watercourses than if left solely to matters of chance. Although this analysis is superficial in certain ways, it does tend to support the argument that PLL and watercourse improvement are more complementary than competitive in nature. This analysis also demonstrates that there is a tendency for PLL farmers to be located on improved watercourses and thereby more readily come into contact with OFWM personnel and learn more about the PLL program.

The fifth hypothesis, that the parcels (location-sites) of PLL farmers are more likely to be on improved watercourses than the parcels of No PLL farmers, was also not substantiated as shown by Table 7.

Not only were PLL farmers' parcels (not "plots" or "bunded units," but location-sites of land) not generally on improved watercourses, as 78% of all parcels were on unimproved watercourses; but there was no significant difference between PLL and No PLL farmers with regard to type of watercourse. The distinction made in this table between the two OFWM coordination offices also yielded nothing of significance or relevance. Again, however, it must be remembered that because of the biased sample, we are to some degree analyzing distinctions between larger vs. smaller farmers, as well as between PLL and No PLL farmers.

The speculation that No PLL farmers are generally more fragmented in terms of land holdings (hypothesis No. 6) was substantiated, as shown by Table 8. The chi-square test showed that the two-way effect of parcel size between PLL and No PLL farmers was highly significant. Only 15% of all PLL farmers had their land in location-sites of 5 acres or less, whereas 36% of all No PLL farmers had land in location-sites of

Table 7. Number, size and location of parcels (location sites) in terms of type of watercourse (PLL vs. No PLL)--row percentages.

	PLL			No PLL		
	IWC No. (%)	UIWC No. (%)	TOTAL No. (%)	IWC No. (%)	UIWC No. (%)	TOTAL No. (%)
Faisalabad	12 (24)	37 (76)	49 (100)	15 (33)	31 (67)	46 (100)
Sahiwal	17 (22)	60 (78)	77 (100)	10 (20)	39 (80)	49 (100)
Total	29 (23)	97 (78)	126 (100)	25 (26)	70 (74)	95 (100)
PLL/No PLL vs. C.O.				: $\chi^2 = 1.638$	1 df	s.l. = 0.50 (NS)
PLL/No PLL vs. IWC/UIWS				: $\chi^2 = 0.166$	1 df	s.l. = 0.90 (NS)
C.O. vs. IWC/UIWC				: $\chi^2 = 1.081$	1 df	s.l. = 0.50 (NS)
PLL/No PLL vs. C.O. vs. IWC/UIWC				: $\chi^2 = 0.232$	1 df	s.l. = 0.90 (NS)

Table 8. Parcel size (land fragmentation)(PLL vs. No PLL)--column percentages.

Size of Parcel	PLL		No PLL		Total		
	No.	(%)	No.	(%)	No.	(%)	
0.5 acre or less	0	(0)	3	(3)	3	(1)	
0.5 - 1 acre	1	(1)	7	(7)	8	(4)	
1 - 5 acres	18	(14)	25	(26)	43	(19)	
Greater than 5	107	(85)	60	(63)	167	(76)	
Total	126	(100)	95	(100)	221	(100)	
Parcel size vs. PLL/No PLL:					$\chi^2 = 17.870$	3 df	s.l. = 0.001

5 acres or less. However, there may again be a farm size effect at work here.

The seventh hypothesis that position on the watercourse (head, middle, tail) has an effect on the parcels (location sites) being precision leveled, and specifically that such parcels are more prevalent at the tail of any watercourse (where water is in relatively and absolutely scarcer supply) was not substantiated by the data (Table A1 in the Appendix). None of the two-way effects including parcel size and watercourse position, effect of parcel size and type of watercourse, and the two-way effect of type of watercourse and watercourse position proved significant. The three-way effect of parcel size, type of watercourse, and watercourse position was significant at the 10% level, but this is of minimal importance. We were unable to discern any tendency for PLL to be more prevalent at the tail of the watercourse where water is in scarcer supply. Twenty-seven percent of all PLL parcels were at the head, 44% at the middle, and 30% at the tail.

The eighth hypothesis, that PLL farmers generally sell or trade more cash crops than No PLL farmers, was verified as shown in Table 9. A chi-square test on the two-way effect of PLL/No PLL and degree of cash farming revealed a 0.1% significance level (highly significant). Seventy-two percent of all PLL farmers sold more than 50% of their crops, whereas only 50% of all No PLL farmers sold more than 50% of total crops. The degree of cash farming showed a 10% significance level when compared with the two C.O.'s, but the three-way test between PLL/No PLL, degree of cash farming, and C.O. revealed nothing of significance.

It was suspected that the degree of cash farming was related to farm size (for all farmers), and the chi-square tests showed this to be

Table 9. Degree of cash farming (percentage of crops sold or traded) (PLL vs. No PLL) - column percentages.

% Cash Farming	PLL				No PLL							
	Faisal. No.	Faisal. (%)	Sahiwal No.	Sahiwal (%)	Total No.	Total (%)	Faisal. No.	Faisal. (%)	Sahiwal No.	Sahiwal (%)	Total No.	Total (%)
0-25	2	(7)	0	(0)	2	(3)	12	(40)	5	(17)	17	(28)
26-50	11	(37)	4	(13)	15	(25)	5	(17)	8	(27)	13	(22)
51-75	12	(40)	16	(53)	28	(47)	12	(40)	12	(40)	24	(40)
76-100	5	(17)	10	(33)	15	(25)	1	(3)	5	(17)	6	(10)
Total	30	(100)	30	(100)	60	(100)	30	(100)	30	(100)	60	(100)

PLL/No PLL vs. Degree of cash farming: $\chi^2=16.150$ 3df s.l.=.001
 Degree of cash farming vs. C.O.: $\chi^2=6.911$ 3df s.l.=.10
 PLL/No PLL vs. Degree of cash farming vs. C.O.: $\chi^2=5.105$ 3df s.l.=.50 (NS)

Table 10. Degree of cash farming and farm size (all farmers).

% Cash Farming	OWNERSHIP SIZE				OPERATIONAL SIZE			
	Very Small No.	Small No.	Large No.	Total No.	Very Small No.	Small No.	Large No.	Total No.
0-25%	13	6	0	19	8	8	3	19
26-50%	10	15	3	28	9	8	11	28
51-75%	21	24	7	52	7	20	25	52
76-100%	3	14	4	21	0	7	14	21
Total	47	59	14	120	24	43	53	120

Degree of Cash Farming vs. Ownership Size: $\chi^2=13.648$ 6df s.l.=.05
 Degree of Cash Farming vs. Operational Size: $\chi^2=18.978$ 6df s.l.=.01

the case (see Table 10). There was a resultant 5% significance level from relating degree of cash farming to ownership size, and a 1% level when relating cash farming to operational size. Large farmers tended to sell or trade more of their total crop production than small, and small farmers more than very small farmers, with the trend being more pronounced when looking at operational size of holding.

The ninth hypothesis, that PLL farmers are generally more in the part-time farmer status category (and that No PLL farmers are more in the full-time category), was not substantiated. There was no significant difference between PLL and No PLL farmers with regard to farmer status, as shown in Table A2 in the Appendix. Seventy-five percent of all PLL farmers are full-time and 77% of all No PLL farmers are full-time.

Last in this series of hypotheses concerning the degrees of subsistence farming is the hypothesis that PLL farmers are less dependent than No PLL farmers on the farm as their sole source of income. When this hypothesis was tested via use of the chi-square method, it provided rather inconclusive results.

There was no discernable difference between PLL and No PLL farmers with respect to degree of cash farming (.90 significance level from the chi-square test), as shown in Table 11. However, there does appear to be a high degree of correlation between degree of cash farming and operational size, suggesting that larger operational farmers earn more of their incomes off the farm than smaller operators. The three-way tests suggest that different degrees of cash farming, when compared between PLL and No PLL farmers, relates to different categorizations of farm size. This is an important result as this is one measure of "progressiveness" for which a real effect of PLL vs. No PLL farmers independent of farm size could be detected. The smaller PLL farmers were more market oriented than those that did not participate (No PLL farmers).

The assumption (No. 11) that PLL farmers generally own their own tractor(s) and that PLL farmers generally own tractors to a greater degree than do No PLL farmers was substantiated at a high degree of significance, as illustrated in Table 12. The chi-square tests illustrated that the distinctions between PLL and No PLL farmers and

Table 11. Degree of cash farming and farm size (PLL vs. No PLL).

	PLL				No PLL			
	100% No.	50-99% No.	0-49% No.	Total No.	100% No.	50-99% No.	0-49% No.	Total No.
<u>Ownership</u>								
<u>Size</u>								
Very Small	10	6	1	17	11	6	6	23
Small	21	7	4	32	21	2	4	27
Large	9	1	1	11	6	4	0	10
Total	40	14	6	60	38	12	10	60
<u>Operational</u>								
<u>Size</u>								
Very Small	2	0	1	3	11	2	6	19
Small	15	4	1	20	21	0	4	25
Large	23	10	4	37	6	10	0	16
Total	40	14	6	60	38	12	10	60

PLL/No PLL vs. Degree of Cash Farming : $\chi^2 = 1.205$ 2df s.l.=0.90 (NS)

Degree of Cash Farming vs. Ownership Size : $\chi^2 = 5.569$ 4df s.l.=0.50 (NS)

Degree of Cash Farming vs. Operational Size: $\chi^2 = 20.987$ 4df s.l.=0.001

PLL/No PLL vs. Degree of Cash Farming vs.
Ownership: $\chi^2 = 7.681$ 4df s.l.=0.10

PLL/No PLL vs. Degree of Cash Farming vs.
Operational: $\chi^2 = 15.195$ 4df s.l.=0.01

Table 12. Tractor ownership (PLL vs. No PLL) - corner percentages.

No. of Tractors	PLL			No PLL		
	Faisal. No. (%)	Sahiwal No. (%)	Total No. (%)	Faisal. No. (%)	Sahiwal No. (%)	Total No. (%)
0	12 (20)	7 (12)	19 (32)	27 (45)	22 (37)	49 (82)
1+	18 (30)	23 (38)	41 (68)	3 (5)	8 (13)	11 (18)
Total	30 (50)	30 (50)	60(100)	30 (50)	30 (50)	60(100)

PLL/No PLL vs. Tractor Ownership: $\chi^2 = 28.541$ 1df s.l. = .001

Tractor Ownership vs. C.O.: $\chi^2 = 2.749$ 1df s.l. = .01

PLL/No PLL Vs. Tractor Ownership & C.O.: $\chi^2 = 0.534$ 1df s.l. = .50 (NS)

tractor ownership were very significant at the 0.1% level. The chi-square test on tractor ownership and Coordinator Office revealed a 10% level of significance, implying a probable difference between Faisalabad and Sahiwal with regard to tractor ownership--some 65% of all Faisalabad farmers (PLL and No PLL) did not own a tractor, whereas only about 50% of all Sahiwal farmers did not own a tractor. The three-way interaction between PLL/No PLL, tractor ownership, and C.O. did not yield any significant correlation.

It was suspected that tractor ownership would show a definite relationship to farm size, and this was substantiated, as shown in Table 13. The significance levels for the two-way tests between both tractor ownership and ownership size, and tractor ownership and operational size, proved highly significant at the 0.1% level. Even the

Table 13. Tractor ownership and farm size (PLL vs. No PLL) -corner percentages.

	PLL			No PLL		
	0 No. (%)	1+ No. (%)	Total No. (%)	0 No. (%)	1+ No. (%)	Total No. (%)
<u>Ownership</u>						
<u>Size</u>						
Very Small	8 (13)	9 (15)	17 (28)	28 (47)	2 (3)	30 (50)
Small	11 (18)	21 (35)	32 (53)	21 (35)	6 (10)	27 (45)
Large	0 (0)	11 (18)	11 (18)	0 (0)	3 (5)	3 (5)
Total	19 (32)	41 (68)	60(100)	49 (82)	11 (18)	60(100)
<u>Operational</u>						
<u>Size</u>						
Very Small	4 (7)	0 (0)	4 (7)	18 (30)	1 (2)	19 (32)
Small	12 (20)	7 (12)	19 (32)	20 (33)	5 (8)	25 (42)
Large	3 (5)	34 (57)	37 (62)	11 (18)	5 (8)	16 (27)
Total	19 (32)	41 (68)	60(100)	49 (82)	11 (18)	60(100)

Ownership Size vs. Tractor Ownership: $\chi^2=22.945$ 2df s.l.=.00
 Operational Size vs. Tractor Ownership: $\chi^2=35.223$ 2df s.l.=.00
 PLL/No PLL vs. Operational Size vs. Tractor Ownership: $\chi^2=18.151$ 2df s.l.=.00

three-way interaction between PLL/No PLL, operational size, and tractor ownership proved highly significant. This implies that (1) large farmers own tractors to a greater degree than small farmers, and small farmers to a greater degree than very small farmers, and (2) that larger PLL farmers tend to own tractors to a greater degree than larger No PLL farmers.

Table 14 reveals that there is a significant variation between the source of water supplies with regard to PLL and No PLL farmers. Hypothesis No. 12, that PLL farmers tend to own their own tubewells (TW) as opposed to No PLL farmers, seems to hold true by a margin of about two to one considering the effects of "canal only" and "canal and own TW" together. The chi-square test shows that there is most likely significant (10%) interaction between PLL/No PLL and source of water. PLL farmers tend to rely on own tubewell water to a greater extent than No PLL farmers, and No PLL farmers rely more heavily on canal and the purchase of tubewell water from other farmers. This again may be related to the fact that the PLL farmers in the PLL sample were larger in farm size than the No PLL farmers.

The hypothesis that PLL farmers generally have a perceived lack of water (and for this reason desire PLL), whereas No PLL farmers have sufficient quantities of water, in both rabi and kharif seasons, was not substantiated by the data, as indicated in Table 15. No significant difference was found between PLL and No PLL farmers with regard to the percentage of water needs met in both rabi and kharif. The table also shows that 69% of the PLL farmers feel that between 76-100% of their water needs are met in both seasons. Therefore, there is not a noticeable greater perceived lack of water by PLL farmers. It is interesting

Table 14. Source of water supply (PLL vs. No PLL) - corner percentages.

Sources	PLL		Total No. (%)	No PLL		Total No. (%)
	Faisal. No. (%)	Sahiwal No. (%)		Faisal. No. (%)	Sahiwal No. (%)	
Canal only	7 (12)	2 (3)	9 (15)	12 (20)	3 (5)	15 (25)
Own TW only	6 (10)	2 (3)	8 (13)	3 (5)	0 (0)	3 (5)
Canal + Own TW	7 (12)	16 (27)	23 (38)	3 (5)	11 (18)	14 (23)
Canal + Purchase TW	9 (15)	6 (10)	15 (25)	10 (17)	13 (22)	23 (38)
All other combinations	1 (2)	4 (7)	5 (9)	2 (3)	3 (5)	5 (9)
Total	30 (50)	30 (50)	60(100)	30 (50)	30 (50)	60(100)

PLL/No PLL vs. source of water : $\chi^2 = 7.646$ 4df s.l. = 0.10
 Source of water vs. C.O. : $\chi^2 = 0.033$ 1df s.l. = 0.90 (NS)
 PLL/No PLL vs. source of water vs. C.O.: $\chi^2 = 2.759$ 4df s.l. = 0.90 (NS)

Table 15. Irrigation water needs met in Rabi and Kharif (PLL vs No PLL) - corner percentages.

Z of Needs Met	PLL		Total No. (%)	No PLL		Total No. (%)
	Faisal. No. (%)	Sahiwal No. (%)		Faisal. No. (%)	Sahiwal No. (%)	
0-50%	23 (19)	3 (3)	26 (22)	24 (20)	3 (3)	27 (22)
51-75%	10 (8)	3 (3)	13 (11)	15 (13)	10 (8)	25 (21)
76-100%	27 (23)	54 (45)	81 (68)	21 (18)	47 (39)	68 (57)
Total	60 (50)	60 (50)	120(100)	60 (50)	60 (50)	120(100)

PLL/No PLL vs. % of needs met : $\chi^2 = 4.932$ 2df s.l. = .50 (NS)
 % of needs met vs. C.O. : $\chi^2 = 51.521$ 2df s.l. = .001
 PLL/No PLL vs. % of needs met vs. C.O.: $\chi^2 = 1.192$ 2df s.l. = .50 (NS)

to note that there is a very high degree of correlation between percentage of water needs met and the different C.O. areas. Out of all farmers (PLL and No PLL) in the Faisalabad area, only 40% feel they are getting more than 75% of their water requirements, whereas, over 80% of all farmers in the Sahiwal area perceive that over 75% of their water requirements are being met.

In summary, the information on ownership size of holdings as well as PLL acreages as told to us by PLL farmers was consistently higher than that which was indicated by the OFWM records on PLL. The largest PLL farmers are found in the Khanewal and Toba Tek Singh areas. According to the information provided by the PLL farmers sampled, many of them were ineligible for participation in the cost-sharing scheme (23%), but had nevertheless participated. PLL farmers are generally better educated than No PLL farmers, but we were unable to show an education effect over and above what could be accounted for by the fact that larger farmers (both PLL and No PLL) are generally better educated than smaller farmers. PLL farmers are generally on unimproved watercourses, but leveled parcels tended to be on improved watercourses to a much higher degree than expected. In a separate analysis the two programs of PLL and watercourse improvement were shown to be more complementary than competitive in nature. There is no significant difference between PLL and No PLL farmers with regard to type of watercourse. PLL farmers have considerably less fragmented land holdings than No PLL farmers. Position on the watercourse has no apparent effect on the decision to precision level one's land holdings. PLL farmers sell or trade considerably more of their farm produce (i.e., engage in cash farming) than No PLL farmers, and are more market oriented. Also, larger farmers (both PLL

and No PLL) tend to sell more of their produce than smaller farmers. There is no significant difference between PLL and No PLL farmers with regard to farmer status (full-time and part-time), nor with regard to degree of cash farming. PLL farmers own their own tractors to a degree significantly higher than No PLL farmers, and larger farmers overall own their own tractors to a greater degree than smaller farmers. PLL farmers tend to own their own tubewells to a greater degree than No PLL farmers, with No PLL farmers more dependent on canal water and purchasing tubewell water. There was no significant difference between PLL and No PLL farmers with regard to percentage of water needs met in the two cropping seasons.

IMPACT OF THE PRECISION LAND LEVELING PROGRAM

This section is aimed at not only examining the various impacts, benefits, and costs of the PLL program, but also to attempt to ascertain the reasons why those who participated in the PLL and cost-sharing programs chose to do so. In the fact-finding and questionnaire pre-testing trips it was realized that there were a great variety of different ways by which farmers became aware of the program, many different ways that OFWM personnel participated in the land-leveling work, many different types and sources of PLL implements and equipment used, a wide range of expected benefits and actual benefits realized from PLL, and a wide range of different types and degrees of costs associated with PLL. The questionnaires were then designed with the intention of seeking out more detailed information concerning these many variations, and to test whether any generalizations were possible. The questionnaires also were designed with the hope of testing a number of

hypotheses concerning the PLL program which had been formulated during the course of pre-testing.

The first of these hypotheses was that PLL farmers came into contact with the PLL program in different ways than No PLL farmers, and also that larger farmers tend to come into contact with the program in different ways than smaller farmers. Table 16 shows that there was a very significant difference in the way PLL and No PLL farmers found out about the program. There are, of course, many ways for a farmer to hear about any government program and PLL is no exception. Most farmers heard about PLL in a number of ways, which Table 16 (a summary table of the different ways farmers heard about the program) unfortunately does not reflect very well. From a total of 60 PLL farmers there were a total of 115 responses, or an average of about two responses per PLL farmer. Likewise, there were 112 total responses from all No PLL farmers, or an average of about two responses per No PLL farmer. Nevertheless, the table does show that PLL farmers tended to find out about the program by first either happening to meet an OFWM person or by approaching an OFWM person himself. They then proceeded to find out further details about the program by approaching (going to) their local OFWM office. If they were convinced or persuaded to participate in the program they filled out and submitted an application for PLL and submitted a signed document attesting to the number of acres owned. This document was obtained from the village patwaris in the beginning of the program, but soon thereafter it was decided that such documents were too troublesome and time-consuming for the farmers to obtain. Thereafter, documents signed only by farmers themselves, without the verification of the patwari, were accepted by OFWM as legal attestments of ownership size. If an individual attested

Table 16. Ways of hearing about PLL program (total responses)(PLL vs. No PLL) - column percentages.

Codes	PLL		No PLL	
	No.	(%)	No.	(%)
From fellow villagers	16	(14)	43	(38)
From outside village	7	(6)	7	(6)
Was approached by OFWM	18	(16)	3	(3)
Happened to meet OFWM	25	(22)	11	(10)
Saw OFWM sign and inquired within	6	(5)	0	(0)
Witnessed PLL work in progress	12	(10)	46	(41)
Radio, T.V. etc.	1	(1)	0	(0)
Approached OFWM office	26	(23)	2	(2)
From other Government person	4	(3)	0	(0)
Total	115	(100)	112	(100)

PLL/No PLL vs. Way of hearing about PLL: $\chi^2 = 68.815$ 5df $\alpha.l. = .001$

to owning no more than 25 acres, he or she became eligible for the cost-sharing program.

There is a sharp contrast between the way PLL farmers became aware of the program and the way No PLL farmers came to know of it. While 68% of the PLL responses related to meeting OFWM personnel, only 15% of the No PLL responses related to meeting OFWM; including being approached by OFWM, happening to meet an OFWM person, seeing the OFWM office sign and inquiring within, or actually approaching or seeking out the OFWM office for detailed information. No PLL farmers tended, by and large, to hear about the program through second-hand sources--79% of the responses indicated that No PLL farmers heard about the program both from fellow villagers and by witnessing PLL work in progress in their own village or in a neighboring village. The chi-square test showed a very significant difference at the 0.1% level between PLL and No PLL farmers in the ways of hearing and coming to know about the program. These results suggest that being able to meet in some form or other with OFWM personnel, hearing about the program and benefits of PLL, and being able to inquire at the office about the full details of the program were major reasons for participating in the program. Additional tables and related discussion in the next section on constraints on farmers in the PLL program will further strengthen this assertion.

It may also be noted that lack of adequate advertisement and promotion of the program is a major problem and constraint, as indicated by the general lack of response to "Radio, T.V., etc." and "seeing the OFWM sign" as reasons for hearing about PLL. Several farmers said that they were unable to even locate their local OFWM A.T.O. office in order to inquire about the programs of improving watercourses and PLL. Only

3% of all farmers surveyed said they had heard about PLL through media or other advertising sources.

The hypothesis that larger farmers tend to come into contact with the program in different ways than small farmers was substantiated only in terms of operational size (at the 5% level), but not in terms of ownership size (not significant, at the 50% level), as revealed in Table 17. In terms of operational size, the chi-square test shows that there was a significant difference between very small, small and large farmers with regard to way of hearing about PLL. Roughly speaking, a look at the data on operational size shows that relatively more large farmers said they heard about PLL by coming into contact directly with OFWM personnel, than either small or very small farmers. Three-way tests between PLL/No PLL, way of hearing about PLL, and farm size (both ownership and operational) showed strong degrees of interaction.

The next hypothesis made (No. 15) was that there are differences between the arrangements made by the farmer and OFWM to do the PLL work and the actual degree of OFWM participation in the PLL work. This assertion was not substantiated and, in fact, there is essentially no difference shown between the arrangements prior to the PLL work and the actual degree of OFWM participation in the work, as shown in Table 18. Although there is absolutely no significant difference between arrangements made and the actual degree of participation, there is some significant difference (at the 5% level) between the arrangements made and the two OFWM C.O.s, and between the actual degree of OFWM participation and the coordinator offices. In the area serviced by the Sahiwal C.O., nearly 100% of all farmers reported that OFWM participated in the PLL work by providing farmers with OFWM implements, surveying and technical guidance.

Table 17. Ways of hearing about PLL program (total responses) and farm size (all farmers).

Codes	Ownership Size				Operational Size			
	VS	S	L	Total	VS	S	L	Total
	No.	No.	No.	No.	No.	No.	No.	No.
From fellow villagers	29	26	4	59	14	23	20	59
From outside village	4	8	2	14	1	7	6	14
Was approached by OFWM	7	8	6	21	2	6	13	21
Happened to meet OFWM	14	19	3	36	5	16	15	36
Saw OFWM sign & inquired within	3	2	1	6	1	1	4	6
Witnessed PLL work in progress	22	31	5	58	13	29	16	58
Radio, T.V. etc.	0	1	0	1	0	0	1	1
Approached OFWM office	9	15	4	28	2	9	17	28
From other Govt. person	2	1	1	4	0	0	4	4
Total	90	111	26	227	40	91	96	227

Way of hearing about PLL vs. Ownership size: $\chi^2 = 11.583$ 10df
 s.l. = .50 (NS)

Way of hearing about PLL vs. Operational size: $\chi^2 = 20.354$ 10df
 s.l. = .05

PLL/No PLL vs. Way of hearing about PLL vs. Ownership size: $\chi^2 = 21.723$
 10df s.l. = .05

PLL/No PLL vs. Way of hearing about PLL vs. Operational size: $\chi^2 = 29.209$
 10df s.l. = .001

Table 18. Arrangements made by OFWM for PLL vs. actual degree of OFWM participation in PLL - column percentages.

Codes	Arrangments made by OFWM for PLL						Actual degree of OFWM partic.					
	Faisal.		Sahiwal		Total		Faisal.		Sahiwal		Total	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)
1	4	(13)	0	(0)	4	(7)	3	(10)	0	(0)	3	(5)
2	21	(70)	29	(97)	50	(83)	21	(70)	29	(97)	50	(83)
3	3	(10)	1	(3)	4	(7)	2	(7)	1	(3)	3	(5)
4	2	(7)	0	(0)	2	(3)	4	(12)	0	(0)	4	(7)
Total	30	(100)	30	(100)	60	(100)	30	(100)	30	(100)	60	(100)

- Codes: 1. OFWM provides tractor with PLL implements, surveying, and technical guidance.
 2. OFWM provides PLL implements, surveying, and technical guidance (no tractor).
 3. OFWM provides technical guidance only.
 4. Farmer arranges for PLL work privately, OFWM does a final inspection only, and if approved, subsidy is granted.

Arrangements made vs. Actual degree of participation: $\chi^2 = 0.952$ 3df
 s.l. = .99 (NS)

Arrangements made vs. C.O.: $\chi^2 = 8.280$ 3df s.l. = .05

Actual degree of OFWM participation vs. C.O.: $\chi^2 = 8.613$ 3df
 s.l. = .05

Arrangements made vs. Actual degree of participation vs. C.O.: $\chi^2 = 0.033$
 3df s.l. = .90 (NS)

But in the area serviced by the Faisalabad C.O., only 70% reported this degree of participation, 10% reporting that OFWM either provided them with technical guidance only or that they did the PLL work entirely without any OFWM participation, outside of a final OFWM inspection. If the fields passed the final inspection - i.e., were judged "level enough"-- the farmers were granted a subsidy, curiously enough often called by OFWM personnel an "inam", or bonus-reward, for a job well done. It should be noted that these last two arrangements made to PLL land and qualify for a subsidy, were not in any of the PLL project guidelines, and did not include surveying done to determine both the volume of earth to be moved and the unlevel points in the fields.

These peculiar arrangements were no doubt made by certain OFWM personnel largely to meet PLL target goals. However, these arrangements did prove beneficial to smaller farmers. They were, of course, of negligible importance since only seven PLL farmers out of a total of 60 said that such arrangements were made for PLL. As Table A3 in the Appendix shows, of the seven farmers who did PLL their land in these ways (out of a total of 60 sampled) all were very small and small farmers, both in terms of ownership and operational size of holding. The two-way interaction chi-square test between operational size and degree of OFWM participation, revealed a significance level of 0.1%.

The four codes illustrating degree of OFWM participation and the farmer's level of education proved to be highly correlated, with a resulting chi-square significance level of 0.1%. By and large, as Table A4 in the Appendix illustrates, those who utilized OFWM help, implements, and guidance were relatively better educated than those who did not utilize any sizable degree of OFWM assistance (i.e., those

falling in the realms of codes number 3 and 4). Again, however, we must emphasize that the farmers falling under codes 3 and 4 are a very small minority and of negligible importance here.

Likewise, the two-way interaction test between the degree of OFWM participation in PLL and tractor ownership proved to be very significant (at the 1% level) as shown in Table A5 in the Appendix, indicating that those farmers utilizing the maximum degree of OFWM participation tended to own their own tractors to a greater degree than those who utilized a minimum of OFWM participation. The farmers in the latter category tended to utilize their own bullock teams and krah to level their lands to the satisfaction of the OFWM area teams (for purposes of obtaining a subsidy).

The types of implements and equipment used for the PLL work and the degree of farmer utilization of these implements are indicated in Table 19. We find that 97% of all PLL farmers used one or more tractors to PLL their land. Oddly enough, 20% of all farmers also used the traditional method of bullock and krah to PLL land. Within this group are those who utilized a bare minimum of OFWM participation in the PLL work (we have already briefly discussed this group of farmers above), as well as a number of farmers who used their bullocks and krah to level their lands prior to, and in anticipation of, the PLL work done with mechanized equipment. In order to save on the time needed for tractor and OFWM implement usage (and rental charges), several farmers did some leveling with bullocks and krah prior to their precision leveling work. Of the 12 farmers who used bullocks and krah, only two made exclusive use of them, and received a subsidy, whereas 10 used them sparingly in anticipation of their PLL work with tractors and implements.

Ninety-two percent of all farmers utilized one or more land planes (commonly referred to as blades or tractor krahs), 85% used one or more scrapers, while only 3% and 7% used chisel plows and discs (also called "ridgers") respectively. It should be noted that a landplane is actually a different implement than a blade (tractor krah). A land plane consists of a wide blade that has some means of controlling its elevation with respect to the average elevation over which it is traveling. This is typically accomplished by special wheels on the plane, or by making use of the tractor's front wheels through the hitch mechanism. The blade must also have a support some distance behind its blade. A simple blade, on the other hand, is a scraping implement with no means of sensing high and low spots in the field.

One farmer was able to rent a bulldozer from the Ministry of Agriculture (under the auspices of the OFWM office) to aid in the leveling of his land.

The sources of the equipment used for PLL varied greatly, especially with regard to tractors and land planes, as demonstrated by Table 20. Over one-half of all tractors used by sample farmers for PLL were privately owned (owned by the farmers themselves). Another 31% of the tractors used were obtained from private (within the village) rental sources. Only 9% were obtained through OFWM (the tractors rented out through OFWM were usually obtained through PAASCO). Land planes (i.e., blades) were by and large obtained through the OFWM offices, although a sizable number of farmers were in possession of their own land planes (blades). The OFWM offices served as the exclusive source for the majority of the scrapers used, although one farmer claimed owning one of his own. The vast majority of farmers

Table 20. Source of PLL implements (PLL only) - column percentages.

	Tractor		Land Plane		Scraper		Bullock & Krah		Chisel Plow		Disc		Bulldozer	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)
Own	29	(50)	7	(13)	1	(2)	9	(75)	0	(0)	0	(0)	0	(0)
Private	18	(31)	3	(5)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)
OFWM	5	(9)	34	(62)	48	(94)	0	(0)	2	(100)	4	(100)	1	(100)
Own + OFWM	1	(2)	6	(11)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)
All Other Combinations	5	(9)	5	(9)	2	(4)	3	(25)	0	(0)	0	(0)	0	(0)
Total	58	(100)	55	(100)	51	(100)	12	(100)	2	(100)	4	(100)	1	(100)

felt that a scraper was much too expensive to buy, and also were unaware of private sources (i.e., contractors) as a source for scrapers. As suspected, almost all of the bullock krahs used for PLL were privately owned, and all of the other mechanized PLL implements (when used) were obtained through the OFWM offices.

The hypothesis (No. 18) that the number of days between when the arrangements were made and when the PLL work actually started were related to farm size was not substantiated. There was no tendency for large farmers to get arrangements made and work started more quickly than small farmers. With regard to duration of the actual work, there was no difference between the C.O. offices of Faisalabad and Sahiwal, nor was duration of work related to farm size. This implies that there is no tendency for larger farmers to take more or less time to do PLL than small farmers. Tables concerning these factors are given in Appendix A (A6, A7, A8).

There appeared to be a weak relationship between duration of PLL work and PLL acreages with the larger acreages requiring longer duration, hardly a surprising result (Table A9).

There is a stronger tendency (5% s.l.) for duration of PLL to increase when a tractor is owned (see Table 21); suggesting either (1) that those who own tractors are leveling more land, and/or (2) that those who own tractors tend to use them for PLL work when they are not busy on other jobs, while farmers not owning a tractor tend to rent one and finish all their PLL work at one time.

BENEFITS AND COSTS OF PLL

We are now in a better position to further analyze the impact of the PLL program by examining the benefits and costs of PLL. As was stated earlier, it was not in the scope of work of this project to

Table 21. Duration of PLL work and tractor ownership - corner percentages.

No. of Tractors	1-7 Days		8-25 Days		More than 25 Days		Total	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
0	5	(10)	6	(12)	1	(2)	12	(24)
1+	4	(8)	21	(41)	14	(27)	39	(76)
Total	9	(18)	27	(53)	15	(29)	51	(100)

Duration of PLL work vs. Tractor Ownership: $\chi^2=7.526$ 2df s.l.=.05

attempt a benefit-cost analysis of PLL. An attempt was made to simply identify the major benefits and costs, and to rank them in terms of relative importance. A total of 21 different benefits and 13 different costs were identified. Consolidation of the 21 benefits was made until 14 major types of benefits could be identified. Farmers were asked to identify not only the benefits actually realized after PLL, but also the benefits they expected to gain before PLL (or put another way, why they decided to do PLL).

Hypothesis No. 20 states that the benefits identified by the farmer as actually experienced after PLL are generally related to saving water and increasing production and yield. Table 22 indicates that this hypothesis is substantiated. Farmers indicated many benefits either expected or actually realized from PLL. Through the probing technique we were able to rank the benefits given according to the first most important down to the fifth most important. Since a complete presentation of all of these benefits by ranked order would by necessity be very lengthy, the data was compressed into Table 22. Since there was a total of 234 responses given by 60 PLL farmers for the actual benefits experienced from PLL, and a total of 228 responses given for the expected benefits of PLL, this implies that there were an average of about four responses given per PLL farmer.

The most important benefit realized from PLL is reduced time to irrigate or less water used per acre. Attempts were made to discern how much irrigation time was reduced after PLL. Farmers were asked their time to irrigate a plot before and after it was precision leveled. Due to time and manpower constraints, no attempt was made to scientifically measure and substantiate these findings. The author does not intend for considerable emphasis to be put on these "measures of improvement,"

Table 22. Expected benefits vs. actual benefits experienced after PLL (PLL only) - Column Percentages.

Codes for benefits	Expected benefits of PLL			Actual benefits experienced after PLL		
	Faisal. No. (%)	Sahiwal No. (%)	Total No. (%)	Faisal. No. (%)	Sahiwal No. (%)	Total No. (%)
1	29 (25)	28 (25)	57 (25)	30 (25)	29 (25)	59 (25)
2	23 (20)	28 (25)	51 (22)	25 (21)	29 (25)	54 (23)
3	12 (11)	21 (18)	33 (14)	15 (13)	22 (19)	37 (16)
4	5 (4)	13 (11)	18 (8)	7 (6)	13 (11)	20 (9)
5	9 (8)	3 (3)	12 (5)	10 (8)	6 (5)	16 (7)
6	6 (5)	7 (6)	13 (6)	8 (7)	6 (5)	14 (6)
7	7 (6)	1 (1)	8 (4)	8 (7)	0 (0)	8 (3)
8	8 (7)	1 (1)	9 (4)	6 (5)	1 (1)	7 (3)
9	4 (4)	5 (4)	9 (4)	2 (2)	3 (3)	5 (2)
10	1 (1)	0 (0)	1 (0)	3 (3)	2 (2)	5 (2)
11	3 (3)	4 (4)	7 (3)	2 (2)	3 (3)	5 (2)
12	2 (2)	0 (0)	2 (1)	2 (2)	0 (0)	2 (1)
13	2 (2)	2 (2)	4 (2)	1 (1)	1 (1)	2 (1)
14	3 (3)	1 (1)	4 (2)	0 (0)	0 (0)	0 (0)
Total	114 (100)	114 (100)	288 (100)	119 (100)	115 (100)	234 (100)

Codes:

1. Reduced time to irrigate (less water per acre).
2. Better crop production (higher yields).
3. Easier operation of tractor and equipment (increase in plot size); effective utilization of modern agricultural equipment.
4. Reduction in hired labor costs.
5. Improvement of status.
6. Reduction in family labor time.
7. Easier operation of bullocks and equipment (increase in plot size).
8. Increase in cropping intensity.
9. Reclamation of waste or defective land.
10. Improved suitability of plots for growing vegetables and/or orchard.
11. Reduction in the number of watercourses; change of watercourse used to irrigate plot(s); reduction in water loss (i.e., seepage).
12. To make experimental plots, to learn about PLL in order to PLL my land by myself alone in the future.
13. Reduction or removal of waterlogging and salinity problem; reduction in silting problem; reduction or removal of flooding problem.
14. Obtaining subsidy.

Expected vs. actual benefits: $\chi^2 = 10.046$ 13df s.l. = .90 (NS)
 Expected vs. actual benefits vs. C.O.: $\chi^2 = 0.008$ 1df s.l. = .95 (NS)
 Benefits vs. C.O.: $\chi^2 = 32.288$ 13df s.l. = .01

especially since we only utilized the farmers' responses and also since only one-third of the PLL farmers were asked these questions, (due to oversights by both the author and his research assistants). Nevertheless, based upon the total of 21 farmers asked, the average response given to inquiries about the reduction in time to irrigate was 33%.

This average of 33% reduction in time to irrigate translates into individual farmer benefits of (1) irrigating additional banded fields to a greater extent (especially fields further away from the nakkas), (2) increasing cropping intensity, (3) increasing yield on the leveled fields, as well as on other non-PLL fields, and (4) increasing cultivation of high water requirement crops such as fruits, vegetables, sugarcane, rice and maize. This and many other benefits may also be translated into social benefits for Pakistan as a whole, although determination of the degree that this is so would necessitate more detailed analysis.

The second most important benefit of PLL is better crop production and higher yields. From a sample size of twenty, the average increase in yield was approximately 27%. To provide an example, if a farmer previously realized 10 maunds per acre of wheat, and after PLL realized 12.7 maunds of wheat, we would say he experienced a 27% increase in yield ($\frac{12.7-10}{10} \times 100$). However, no effort was made to isolate the independent effect of PLL on yield, since this was outside the realm of this study. Some of the increase in yield could have been due to improved agronomic practices as a result of contact with DFWM workers.

The third most important benefit is easier operation of tractor and equipment, i.e., an increase in plot size by reducing the number of banded units, and more effective utilization of modern agricultural equipment. From a sample size of only eight, informants said that they

had experienced an average 38% improvement in time needed to perform their crop-related duties (plowing, planting, cultivating, etc.) on plots which had been precision leveled.

The fourth most important benefit is a reduction in hired labor costs. This implies that farmers were employing fewer laborers to work their fields after PLL. This is no doubt related to the reduction in the number of banded units and greater ease in utilizing modern agricultural equipment and technologies experienced on precision leveled parcels (location-sites). From a sample size of only eight, farmers said they had experienced a 33% average reduction in hired labor costs.

The fifth most important benefit is an improvement of status. Farmers surveyed would consistently rank improvement of status as the fourth or fifth most important benefit realized by PLL. A number of farmers also said that they expected to realize this benefit before the PLL work was actually begun (5%). In the pre-testing periods, farmers often said that one of the major benefits they felt after PLL was that their "fields looked nice" and that fellow and neighboring villagers passing by would comment on the nice appearance of the precision leveled fields to the farmers who had had PLL done themselves and to others as well. PLL farmers seemed to feel that this constituted an improvement of their status in the eyes of others because it implied that (1) they were viewed as progressive farmers, (2) they were viewed as having enough money to afford PLL, and (3) they were viewed as having "approach" to OFWM officials. By having "approach", we mean that farmers viewed this as meaning having enough political, social, and economic connections and power to accomplish a given administrative or bureaucratic task or goal. In English we might define this as "having pull." In relation to

PLL, it meant that by using his connections with influential people in governmental agencies and/or ministries, etc., plus connections with friends and persons who themselves had the proper "approach," a farmer could muster enough people and resources (influential connections and large enough and liquid enough resources frequently go hand-in-hand) to aid him in getting the OFWM people and implements out to his farm to PLL his land, to level as much land that he desires, in the way he desires, and to level it when desired.

If a farmer is already quite influential and wealthy in his village or chak, getting PLL may serve to further confirm his status. To a farmer whose status was perhaps not as high as he would like it to be, PLL may have been a way of increasing his status in his own eyes and in the eyes of others. To what degree one's status is increased by PLL is a matter of pure conjecture. If a benefit-cost study was done on PLL it would no doubt prove exceedingly difficult to put a relatively scarce value on improvement of status, and consequently would probably be left out of such an analysis. Nonetheless, it is an important fact in the success of each thereof in development programs, such as PLL.

The sixth most important benefit is a reduction in family labor time, implying that less time was taken by the farmer and his family for field operations after PLL. This is closely related to the benefit of a reduction in hired labor costs. From a sample size of only eight, farmers said they had experienced a 34% average reduction in family labor time on PLL parcels or location-sites.

The remaining eight benefits cited by farmers are of relatively small importance and therefore will not be discussed in detail. Interested readers may, however, refer to Table 22. The chi-square tests between

the expected and actual benefits of PLL and between the expected and actual benefits and the two C.O.'s revealed nothing of significance. There was a high degree of significance at the 1% level between the fourteen benefits of PLL and the C.O.'s. There seemed to be a preponderance for farmers in Faisalabad to experience the benefits of increase in cropping intensity, easier operation of bullocks and equipment, and improvement of status than did farmers in Sahiwal. Likewise, there was a tendency for farmers in Sahiwal to experience the benefits of easier operation of tractor and equipment and reduction in hired labor costs to a greater degree than did farmers in Faisalabad.

The hypothesis formulated during the course of this survey that the benefits of PLL are generally related to saving water and increasing production and yield proved to be true, although there are other very important benefits realized as well. The hypothesis that the expected benefits of PLL match the benefits actually experienced after PLL was also substantiated, since the chi-square test showed no significant difference between the two.

The costs of PLL were investigated in two distinct ways. First, the direct, indirect, and total costs of PLL were determined in rupees. Second, attempts were made to accurately identify and rank the most troublesome and significant costs of PLL as perceived by farmers. Table 23 presents the results found according to rupee costs per acre in both mean and median values, and also presents the mean and median subsidies received per acre (mean rupee values are related to mean acreages, and median rupee values to median acreages). The direct costs of PLL were measured as the sum of the costs of own tractor fuel and labor time, tractor rental (ranging between Rs. 35-45 per hour in most areas of PLL

Table 23. Costs (Direct, Indirect, and Total) of PLL per acre vs. Amount of Subsidy per acre - Mean and Median values in rupees (PLL Only).

OFWM Area Team and Coordinator Offices	Direct		Indirect		Total		Subsidy	
	Cost per Mean Acre	Cost per Med.Acre	Cost per Mean Acre	Cost per Med.Acre	Cost per Mean Acre	Cost per Med.Acre	per Mean Acre	per Med.Acre
Jaranwala	421	464	151	29	572	493	203	198
Toba Tek Singh	360	305	82	210	442	515	239	221
Chiniot	382	477	102	156	485	634	189	232
Total	380	464	108	113	483	577	217	220
Faisalabad	481	332	476	24	957	356	147	230
Sahiwal	402	479	204	144	606	624	145	191
Chichawatni	483	285	91	226	574	511	168	135
Total	467	490	187	81	653	572	159	197
Sahiwal	424	414	151	166	579	579	185	200
Total all PLL farmers	424	414	151	166	579	579	185	200

work), OFWM equipment rental, equipment rental from private sources, and any hired labor costs for PLL work.

We found a variety of indirect costs related to PLL including:

1. The cost of entertainment of OFWM staff such as food, tea and soft drinks during the course of PLL work.
2. The expenses incurred either in getting the subsidy check from the OFWM office or in getting the subsidy check cashed from the bank. These would include transportation, food and lodging charges incurred in going to either the bank or OFWM offices to attempt to speed up the bureaucratic process, as well as any kickbacks or payments in money or kind to bank officials.
3. The loss of a cropping season and any income lost thereby.
4. Maintenance costs of fields after PLL such as touch-up work with tractor and land plane or bullocks and krah.
5. Loss of trees uprooted for PLL.
6. Overhaul of tractor engine as a result of the strain put on it during PLL. This is, of course, a questionable item as one cannot be sure of the cause of failure.

The total costs of PLL are the sum of all direct and indirect costs.

From Table 23, we see that for all the sample farmers the total costs (both mean and median values are rupees 579) are approximately 40% greater than the direct costs (mean=424, median=414), and that direct costs are approximately 1½ times (150%) greater than the indirect costs (mean=151, median=166). However, the figures for indirect costs may be somewhat misleading and not accurately represented here. No effort was made to determine any shadow prices involved nor to assign relatively scarce (marginal) values to these costs. As opposed to the monetary,

or direct, costs of PLL, the indirect costs are more the subjective costs of the farmer and more prone to miscalculation. It is probably the case that the indirect costs of (1) getting the subsidy check cashed from the bank and (2) loss of cropping season would be assigned considerably higher values if a complete benefit-cost study were attempted.

The mean and median subsidy values per acre are roughly one-half of the mean and median direct cost values, which is what is to be expected. The subsidy, based upon the volume of earth moved, was designed to cover approximately 50% of the costs of PLL--and according to the data presented in this report, it does succeed in this respect. However, when reviewing the data presented on total costs of PLL, we find that the subsidy accounts for only about one-third of the cost. If adjustments were made to all of these costs, especially the indirect costs, based upon shadow prices and relatively scarce values, it is likely that the subsidy would pay for even less than one-third of the total cost. However, it can be argued that the subsidy was never designed with the expressed purpose of covering one-half of the total costs of PLL, but only one-half of the direct costs, and this it appears to do quite well. If a survey were made of a sampling of farmers who have had PLL done in the last year or so, one would no doubt find that the costs of PLL have risen sharply in the face of rising crude oil, wage labor, and tractor and equipment rental rates. The subsidy rate has correspondingly been increased from Rs. 1.50 per cubic meter of earth moved to Rs. 2 in the 1979 year by OFWM, but it is not known whether this increase is enough to cover the rapid increases in prices and wage rates throughout Pakistan.

Table 24 reveals that getting the check cashed from the bank is the third highest cost, i.e., troublesome or significant costs, as perceived by farmers--especially in the Faisalabad area--and that loss of a cropping season is the sixth most significant cost. This table presents a total of 148 responses from a total of 66 PLL farmers, or an average of 2.2 different cost-responses per farmer.

From Table 24, we find that the greatest perceived cost of PLL to farmers is clearly tractor fuel and labor time. This is particularly pertinent to farmers owning their own tractors, whose major expense, by far, is paying for the diesel necessary to run the tractor and for the maintenance of the tractor and equipment. This and the rental of OFWM equipment, the fourth greatest perceived cost of all PLL farmers, often constituted the only major costs to those owning their own tractors. (The costs are probably underestimated for these farmers as no depreciation charge was included.) Nine farmers (or 15% of the total surveyed) who owned their own tractor(s) actually came very close to being reimbursed for all their direct costs of PLL with the help of their subsidy checks. Since they owned their own tractor(s) and much of the equipment needed for PLL (land planes) their expenses per acre for PLL were relatively quite low when compared to farmers who had to rent a tractor and most, if not all, of the equipment from OFWM for the PLL work. Renting a tractor and renting OFWM equipment were cited as the second and fourth most troublesome costs, respectively.

As mentioned above, getting the subsidy check cashed from the bank was the third greatest perceived cost. A total of eight farmers, seven in Sahiwal and one in Faisalabad, or 13% of the total PLL farmers

Table 24. Most troublesome (significant) costs of PLL (PLL only) - column percentages.

Costs of PLL	Faisalabad No. (%)	Sahiwal No. (%)	Total No. (%)
Tractor fuel and labor (direct cost)	15 (19)	21 (30)	36 (24)
Tractor rental (direct cost)	12 (16)	11 (15)	23 (16)
Getting subsidy check cashed (indirect cost)	17 (22)	4 (6)	21 (14)
OF&M equipment rental (direct cost)	7 (9)	12 (17)	19 (13)
Hired labor costs (direct cost)	8 (10)	10 (14)	18 (12)
Loss of cropping season (indirect cost)	6 (8)	4 (6)	10 (7)
Getting the subsidy from OF&M (indirect cost)	5 (6)	2 (3)	7 (5)
All others (indirect cost)	2 (3)	5 (7)	7 (5)
OF&M officials entertainment costs (indirect costs)	4 (5)	1 (1)	5 (3)
Equipment rental from private source (direct cost)	0 (0)	1 (1)	1 (1)
Maintenance costs (indirect cost)	1 (1)	0 (0)	1 (1)
Total	77 (100)	71 (100)	148 (100)

surveyed, reported that they had not received their subsidy money at the time of the survey. This was after an average waiting time of about one year. The procedure followed is for a farmer to either be issued or mailed a subsidy check from OFWM soon after the PLL work has been completed, although as Table 24 shows, seven farmers reported difficulty in getting their checks issued from the OFWM office.

In order to get the subsidy check cashed, the farmer must first deposit the check in a local bank. If, as is usually the case, he does not already have an existing account in a bank, he must open one at the standard charge of Rs. 10. If he has had land leveled in his son's, daughter's, brother's, etc., name he must have these family relations sign over the check(s) to him. The check(s) then go from the local bank to the Revenue Department which controls the funds for this subsidy program and who must approve the check. Oftentimes the check must be sent back to the OFWM office concerned for an official approval or clarification. The check may be passed around governmental departments in this way for some period of time. Occasionally the check may remain somewhere within the Revenue Department for a considerable amount of time with no action being taken on its approval and release for payment. When efforts by OFWM personnel (at the appeals of the farmers) to get Revenue Department officials to take action on the payment of checks are not successful, farmers must invariably go personally to the Revenue office to try and remedy the situation. Since some 35% (21 out of 60) of all sample farmers said that they had had problems in getting their checks cashed, this implies that it is a serious problem with the program. Several farmers reported having to pay bribes, either in kind or money, to bank officials; and having to make repeated trips to Revenue and bank offices to get their checks cashed. Several farmers (eight

in total) have not to this day succeeded in getting their check(s) cashed, and have all but given up trying.

The final hypothesis made with regard to the impact of the PLL program was that farmers who have had PLL are anxious to get more, unless all of their land has already been precision leveled. We found that 78% (47 out of 60) of all sample farmers were interested in getting more PLL for their farms. Of the 22% (13 out of 60) who said they were not interested in further PLL, the majority said that the major reasons for this lack of interest were that either there was no need, i.e., their remaining land was already level enough, that there was no more of their land left to PLL, or that they were retiring from farming. Ten other reasons were also given for a lack of interest in future PLL, as indicated in Table 25. There were a total of 23 responses given, or an average of about two responses per farmer.

From the six farmers who gave reasons for lack of interest in future PLL, other than the reason that their remaining land was already leveled to their satisfaction, we asked the question of what would encourage them to avail themselves of more (future) PLL. The results are presented in Table 26. There were a total of 16 responses given, or an average of about three responses per farmer. Five farmers out of the 6 who were asked this question replied that they would be encouraged to get more PLL in the future if the uprooting of trees was not made essential by the OFWM personnel for PLL, or if OFWM could succeed in lowering their water table (and thereby reduce the problems of waterlogging and salinity). Three farmers said they would be encouraged if they had their own tractor or if tractor rental rates were cheaper. A few farmers complained that the PLL work was not done by OFWM when requested by the farmers so that a loss of a cropping season resulted, that adequate technical guidance

Table 25. Reasons for lack of interest in future PLL (total responses; n=13)(PLL farmers only) - column percentages.

Reasons	Faisalabad		Sahiwal		Total	
	No.	(%)	No.	(%)	No.	(%)
No need (land level enough); retiring from farming; no more land to PLL	3	(19)	4	(57)	7	(30)
No tractor--tractor too expensive	1	(6)	1	(14)	2	(9)
Lack of approach	2	(13)	0	(0)	2	(9)
Check too hard to get cashed from bank	2	(13)	0	(0)	2	(9)
Loss of cropping season	2	(13)	0	(0)	2	(9)
Loss of trees	1	(6)	1	(14)	2	(9)
Waterlogging increases after PLL	2	(13)	0	(0)	2	(9)
Private equipment rental too expensive	1	(6)	0	(0)	1	(4)
OFWM takes too long to come and do PLL work	1	(6)	0	(0)	1	(4)
Subsidy too hard to get from OFWM	0	(0)	1	(14)	1	(4)
Status reduced (embarrassment occurred)	1	(6)	0	(0)	1	(4)
Total	16	(100)	7	(100)	23	(100)

Table 26. Encouragements to get more (future) PLL (total responses; n=6)(PLL only).

Reasons	Faisalabad		Sahiwal		Total	
	No.	(%)	No.	(%)	No.	(%)
If no uprooting of trees was necessary; if water table was lowered	4	(33)	1	(25)	5	(31)
Increase in subsidy	2	(17)	1	(25)	3	(19)
If tractor was owned/available/cheaper to rent	2	(17)	1	(25)	3	(19)
If PLL was done when requested and on time	2	(17)	0	(0)	2	(13)
If more technical guidance were provided by OFWM	1	(8)	1	(25)	2	(13)
If check casing procedures were simplified	1	(8)	0	(0)	1	(6)
Total	12	(100)	4	(100)	16	(100)

for PLL was not provided by OFWM, and that the check cashing procedure needed simplifying.

To sum up this section of the report, we have found that those farmers who had PLL were much more likely to be approached by or to somehow come in contact with OFWM personnel than were No PLL farmers, and in this way came to find out the full details about the program. Sixty-six percent of all PLL farmers said they heard about the program by somehow coming into contact with OFWM personnel. Only 15% of all No PLL farmers said they came into contact with the program in this way, with the majority hearing about the program through second and third hand sources. There was also a tendency for larger farmers to have come into contact with OFWM more than smaller farmers. The majority of farmers did their PLL work with an adequate supply of OFWM implements, surveying and guidance. We found that more very small and small farmers were able to get a subsidy and participate in the program without much OFWM participation, than would otherwise have been the case. Those who utilized the maximum degree of OFWM guidance, etc., tended to be better educated farmers who owned their own tractors. We found that tractors, land planes (blades), and scrapers were mainly used to do PLL work, but that some work was done by bullock and krah. Most of the tractors used were either owned by the PLL farmers themselves or were rented from private (village) sources. Most of the land planes (blades) used were rented from OFWM, but a number of PLL farmers reported owning these implements. As noted before, these tractor blades may not have actually been land planes. Scrapers tended largely to be rented from OFWM and bullock krahs were largely owned. Most of the PLL work was begun within two weeks from when all the arrangements between the farmer and OFWM were

finalized. The duration of the PLL work tended to take longer the more acres there were to be precision leveled and if a tractor was owned.

The major benefits of PLL as perceived by farmers were (1) reduced time to irrigate (less water per acre), (2) better crop production and higher yield, (3) easier operation of tractor and equipment (increase in plot size) and more effective utilization of modern agricultural equipment, (4) reduction in hired labor costs, (5) improvement of status, and (6) reduction in family labor time. The major perceived costs of PLL are, in order of importance, (1) tractor fuel and labor time, (2) tractor rental, (3) getting the subsidy check cashed from the bank, (4) OFWM equipment rental, (5) hired labor costs, and (6) loss of a cropping season. The subsidy averaged approximately one-half of the direct costs of PLL, but only about one-third of the total costs. The indirect costs of PLL were larger than expected--about half the average direct costs of PLL.

Farmers seem generally willing and anxious to avail themselves of more (future) PLL, even though most of them do not, of course, qualify for future subsidies unless they are able to somehow subdivide more of their land holdings in the names of other family relations. It was also found that half of the PLL farmers interviewed said that their fields had been inspected at least once after the inspections on which the payments were based.

These "follow-up" inspections are in compliance with OFWM guidelines. However, half said that their fields had not been so inspected. We felt it unlikely that the farmers' fields could have been inspected without the farmers' knowledge, since the presence of any outsider in the village of chak is quickly made common knowledge, and their activities are keenly observed by all.

CONSTRAINTS ON FARMERS IN THE PLL PROGRAM

Having examined some of the major characteristics of PLL and No PLL farmers and farm sizes, some of the major impacts and problems of the PLL program, and the major perceived benefits and costs of PLL, we are now in a position to examine the central concern of this survey: The constraints on farmers, especially the small and very small farmers, in the PLL program. In the pretesting of the questionnaires it was observed that there were many different reasons given by farmers for not participating in the PLL program. By the end of the survey a total of 36 different reasons had been put forward by farmers for not doing PLL, but we were able to combine these into 18 major constraints.

One of the first assumptions made, was that by the nature of our definition of No PLL, farmers so designated were aware of the program but had not attempted to participate. This was generally the case, but 10% of the No PLL (6 out of 60) were found to have actually attempted to avail themselves of PLL. Of these 6 who had tried to get PLL but failed, a majority attributed their failure to lack of approach, i.e., a lack of political, social, or economic "pull," (see discussion of 'approach' in previous section), or because of an inability to get their application processed for various reasons (Table 27).

The actual constraints as perceived by sampled farmers are illustrated in Table 28, which indicates the various reasons reported for not doing PLL. As was the case with some of the previous tables, Table 28 represents all the responses given by farmers with the realization that farmers invariably provided us with more than one reason for not doing PLL. Many farmers provided up to five major reasons for not doing PLL, and then we were able to get farmers to rank these reasons

Table 27. Reasons for not Succeeding in getting PLL. (total responses: n=6) (No PLL only).

C o d e s	Total Farmers	
	No.	(%)
Lack of approach; unable to locate and meet with OFWM; was ignored by OFWM	4	(44)
Application given to OFWM, but no response received; was ruled ineligible for PLL; OFWM said land was too rough to PLL	3	(33)
Laziness	1	(11)
OFWM is going to start PLL work on my farm in near future	1	(11)
Total	9	(100)

Table 28. Reasons for not doing PLL (total responses; n=60) (No PLL only) - Column Percentages.

Codes	Faisalabad		Sahiwal		Total	
	No.	(%)	No.	(%)	No.	(%)
1. Land double cropped (no available land); loss of one cropping season	11	(12)	32	(28)	43	(21)
2. Fields level enough; not convinced of its benefits; lack of knowledge; only recently came to know about PLL program; simply not interested (with no particular explanation); land can be leveled by self; laziness; too busy for PLL	26	(28)	17	(16)	43	(21)
3. Tractor and/or implement rental too costly/not available	17	(18)	20	(18)	37	(18)
4. Mistrust of OFWM (and govt. people in general); reputation of OFWM workers for doing job properly, on time, and when requested is not good	14	(15)	8	(7)	22	(11)
5. Rate of subsidy too low	5	(5)	13	(12)	18	(9)
6. Lack of approach to OFWM	13	(14)	3	(3)	16	(8)
7. Advance subsidy/loan is needed to do PLL	1	(1)	5	(5)	6	(3)
8. Land holding too fragmented; farm size too small	1	(1)	4	(4)	5	(2)
9. Subsidy too difficult to get from OFWM	1	(1)	1	(1)	2	(1)
10. Subsidy check too difficult to get cashed from bank	1	(1)	1	(1)	2	(1)
11. Waterlogging and/or salinity problems too great	1	(1)	1	(1)	2	(1)
12. Land not yet distributed to me (in my control); land ownership not yet transferred among family members	1	(1)	1	(1)	2	(1)
13. Unwilling to uproot trees required in PLL program	0	(0)	2	(2)	2	(1)
14. OFWM requires kickbacks	0	(0)	1	(1)	1	(0)
15. Plots are too far from paved road	1	(1)	0	(0)	1	(0)
16. Bulldozer is required to PLL land, but is not available	1	(1)	0	(0)	1	(0)
17. Tractor maintenance & repair bills due to PLL work are too much	0	(0)	1	(1)	1	(0)
18. Hired labor costs for PLL are too costly and troublesome	1	(1)	0	(0)	1	(0)
Total	95	(100)	110	(100)	205	(100)

in descending order for us. There were an average of approximately two responses per farmer. Table 28 represents the sum of all the reasons (from 1 to 5) given by farmers.

This table reveals that out of the 18 constraints provided, six of them stand out as significant and major constraints. The major constraint on small farmers (all but three of the No PLL farmers interviewed were either very small or small farmers in terms of ownership size) is that there is no available land for PLL, i.e., land is being double cropped and the farmer feels that participation in PLL would result in the loss of a cropping season. This indicates that the majority of land is being utilized to capacity, and none can readily be spared for PLL. Actually the situation is that land is available for PLL for a brief period of about one or two months between cropping seasons, but the majority of farmers feel that this is not enough time to guarantee that any PLL work will be completed before the next crop must be planted. These farmers are so dependent upon their crops and agricultural produce for supplying their basic needs that they cannot afford the loss of a cropping season which may result from being involved in the PLL program. The general feeling is that it will prove difficult to get the PLL work done in time for the next crop, especially since the month-or-so-long period between crops is the period of peak demand for OFWM services with regard to precision leveling.

The second major constraint in terms of importance, is a combination of not being convinced of the benefits of PLL as well as a lack of knowledge about the program. Included in this category are the responses that fields are already level enough, only recently came to know about the PLL program, simply not interested (with no particular explanation given), land can be satisfactorily leveled by self, laziness (no attempt

to find out about the program, as well as a general lack of interest in farming), and too busy to spare time for PLL. Twenty-one percent of all No PLL farmers expressed this as a major constraint, which tells us two things: (1) many farmers who do not participate feel that the costs of PLL outweigh the benefits and that it is not profitable or at any rate easily affordable. Some farmers may feel that it is profitable in the long-run, but not affordable in the short-run. Also, (2) lack of knowledge about the program may be preventing many farmers from participating in the program, a fact which reflects limitations in the operation of the PLL program. Seventeen farmers (out of 60 sampled) or 28%, said that this was a constraint.

The third major constraint is that tractor and/or implement rental is either too costly or, in some cases, not available. We have already seen that lack of tractor ownership was a serious constraint to even those PLL farmers sampled; and who tend to be--as we have shown--larger in farm size, have less fragmentation of land holdings, and engage in more cash-cropping than No PLL farmers; and that tractor rental was the major cost to them of the PLL work. By and large, No PLL farmers are too poor to engage in precision leveling, or at least will admit that they are too poor.

The fourth major constraint is a general mistrust of OFWM and government workers in general, and that the reputation of OFWM workers for doing PLL work properly (efficiently), on time, in the time period between cropping seasons when requested, is not good. Eleven percent of all No PLL farmers interviewed elicited something to this effect. Much of their mistrust and misgivings in concern with OFWM were based on hearsay and from second- and third-hand sources. It should also be

pointed out that we found the reputation of OFWM workers to be considerably higher than that of other Government of Pakistan employees who frequently deal with farmers. Nevertheless, this general suspicion poses a challenge to PLL teams.

There appeared to be a number of complaints against OFWM with regard to the improvement of watercourses, which naturally influenced some farmers to say that one of the reasons why they would not do PLL was because of a mistrust of OFWM and that the reputation of OFWM workers was not good. Complaints with regard to the improvement of watercourses included feelings that OFWM discriminated against small farmers (also relevant with respect to PLL), took long in completion of work, ignored some village applications, practiced in certain corruptions (i.e., concentration of the majority of the culvert-bridges on larger and more influential farmers' lands), and that the benefits accrued to a select minority on the improved and unimproved watercourses. Smaller farmers (especially those in the very small category) also expressed a feeling that OFWM was reluctant to work with them and preferred larger farmers. The pressure, be it small or large, put on OFWM workers to meet the PLL guidelines target goals of each LDO (Land Development Officer) leveling 30 acres of land per month, no doubt was to some degree responsible for their preferential treatment to larger farmers who were willing to PLL more land than smaller farmers.

The fifth major constraint is a feeling that the rate of subsidy is too low. This, in effect, relates to the third major constraint of too costly tractor (and implement) rental rates, since it also corresponds to a feeling of a lack of money to do PLL. This constraint was voiced by considerably more farmers in the Sahiwal area than in the Faisalabad area, and by smaller farmers, in general, as a rule.

The sixth major constraint as perceived by farmers is a lack of approach to OFWM. This implies that many farmers (8% of those surveyed) are not doing PLL, in part, because of a feeling that they are not able to get in touch with the OFWM people, fill out all the necessary applications for PLL, and succeed in getting the OFWM people out to level their fields when desired and get the work completed when desired. This is somewhat related to the constraint of "lack of knowledge," since if certain farmers were more aware of the procedures involved in the PLL program they would perhaps be more able to get PLL work done on their landed holdings. There was a predominance for this sixth major constraint to be felt more so in the Faisalabad area than in the Sahiwal area.

The other twelve constraints listed in Table 28 are of minor importance and are not discussed in detail here.

It was hypothesized that the relative importance of the (6) major constraints in the PLL program would be in some way related to such variables as farm size, degree of cash farming, education level, type of watercourse, tractor ownership, and percentage of irrigation water needs met in the two cropping seasons. In fact, only the last two of these variables, tractor ownership (10% s.l.) and percentage of irrigation water needs met (5% s.l.), showed any relationship to the six major constraints. This implies that there is no strong tendency for farmers citing the various six major constraints to be concentrated in any way among the farm size categories, the degree of cash farming, the education level, or along different types of watercourses. However, there is a tendency for all farmers citing these six major constraints as important, to generally not own tractors, and to be dependent upon bullock power and the rental of tractors from private (village) sources. There is

also a tendency for those No PLL farmers who said that double cropping/loss of a cropping season, and mistrust of OFWM were major constraints to have 75% or less of their irrigation water needs met year-round, and for those who said that lack of knowledge (and not being convinced of the benefits of PLL) and lack of approach to OFWM were major constraints to have more than 75% of their water needs met year-round. However, it appears doubtful that this finding can prove to be of any great relevance with regard to PLL. Relevant tables are not shown in the text but are given in Appendix A (A10, A11, A12, A13, A14, A15).

In summary, we have found that the main constraints on small (and very small) farmers in the PLL program as perceived by the farmers themselves are, in order of importance, (1) loss of a cropping season and double cropping of land, i.e., no available land for PLL, (2) a lack of knowledge about the PLL program and not being convinced of the benefits of PLL, (3) tractor and/or implement rental is too costly, (4) a mistrust of OFWM and government workers in general, (5) the rate of subsidy is too low, and (6) a lack of approach to OFWM. The majority of No PLL farmers had never attempted to get PLL. Of the 10% of all No PLL farmers who did attempt to get PLL, they cited the reasons of lack of approach to OFWM and an inability to get their application for PLL processed as the major reasons for failing to succeed in getting PLL.

At the end of the two questionnaires used for this survey, we asked farmers (both PLL and No PLL) the hypothetical question of: "If you were to ever avail yourself of PLL in the future, what would be the source of performing your future PLL?" The results of this question are presented in Table 29. There was a high degree of significance shown

Table 29. Source of future PLL (PLL vs. No PLL) - column percentages.

	PLL		No PLL		All Farmers	
	No.	(%)	No.	(%)	No.	(%)
Self	7	(13)	17	(29)	24	(21)
Private	0	(0)	2	(3)	2	(2)
OFWM	3	(5)	15	(25)	18	(16)
Self and Private	0	(0)	6	(10)	6	(5)
Self and OFWM	38	(69)	17	(29)	55	(48)
Private and OFWM	1	(2)	0	(0)	1	(1)
Self and Private and OFWM	6	(11)	1	(2)	8	(7)
Total	55	(100)	59	(100)	114	(100)

PLL/No PLL vs. source of future PLL: $\chi^2=32.700$ 6df s.l.=.001

by the chi-square test (significant at the 0.1% level) between PLL and No PLL farmers in response to this question. No PLL farmers tended to say that they would prefer that their future (hypothetical) PLL work be done either by themselves alone (29%), by themselves with some assistance from OFWM (29%), by OFWM alone (25%), and by themselves with the use of private sources for equipment, etc. (10%). Fifty-six percent of all No PLL farmers expressed a desire to work with OFWM in some form for future PLL work.

Most of the No PLL and PLL (87%) farmers expressed a good feeling towards OFWM and the type of work they performed. PLL farmers overwhelmingly tended to say that they would prefer that their future PLL work done by themselves with the assistance of OFWM (69%). Those who had had PLL work done seemed pleased with the work done, but expressed a general desire to be less dependent upon OFWM for future PLL work. The general feeling seemed to be that now that they (PLL farmers) had experienced PLL, they were better able to manage future PLL work by themselves, with less utilization of OFWM personnel and equipment. While 54% of the No PLL farmers felt they needed the help of OFWM to do PLL, another 42% (self + private + self and private) felt that they could level their fields to their own satisfaction in the future without the aid and guidance of OFWM. These farmers said that they would level their fields (and are currently leveling their fields) through the use of bullocks and krah and tractor (usually private rental) and land planes--thereby avoiding the expensive and "troublesome" job of dealing with and through OFWM beyond a certain degree. It seems likely that these farmers still do not understand the necessity of precise surveys for doing accurate land leveling.

With regard to credit facilities available for PLL, we found that there was a somewhat significant difference between what information PLL and No PLL farmers provided to us (significance at the 10% level), as shown in table 30. PLL farmers tended to say, more so than No PLL farmers, that credit was available for tractors, chemical fertilizers and tubewells but not for PLL. No PLL farmers tended to say, more so than PLL farmers, that they would not avail themselves to use credit for PLL because either interest rates and installment payments are too high, because they are opposed to credit due to religious reasons (in Islam), or because it was beneath their dignity and/or prestige to utilize bank loans for any purpose. Only 18% of all farmers surveyed indicated that credit was available for PLL and only one farmer indicated that he had actually received a bank loan for his PLL work.

SUGGESTIONS BY FARMERS

Included as part of the questionnaire was provision for any suggestions from farmers to improve or change the existing PLL program. From these suggestions a table was constructed of the fifteen major types of suggestions forwarded with respect to PLL and No PLL farmers. The results appear in Table 31 below. Many farmers presented four or five different suggestions, while others presented only one or two, which explains why the total number of farmers providing suggestions is 274 (274 responses + 120 total farmers - an average of 2.28 responses per farmer). There is indication from the chi-square test of a high degree of significance (at the 0.1% level) between the types of suggestions provided by PLL and No PLL farmers. PLL farmers tended to provide the suggestions relating to the PLL implements, that the subsidy check should be made easier to get cashed from the bank, and that bulldozers should be made available for PLL work more frequently than No PLL farmers.

Table 30. Credit (PLL vs. No PLL)(total responses).

	PLL		No PLL		Total responses	
	No.	(%)	No.	(%)	No.	(%)
Not interested; no experience	8	(15)	12	(19)	20	(17)
No need, but is available	10	(19)	10	(16)	20	(17)
Available for tractor, chemical fertilizer and tubewell, but not for PLL	23	(43)	13	(20)	36	(31)
Not available at all	0	(0)	1	(2)	1	(1)
Received credit for PLL	1	(2)	0	(0)	1	(1)
Interest rates and installments too high; opposed due to religious reasons; beneath my dignity/prestige	12	(22)	27	(43)	39	(33)
Total	54	(100)	63	(100)	117	(100)

PLL/No PLL vs. credit: $\chi^2 = 10.718$ 5df s.l.=.10

Table 3L. Farmer suggestions - (sum of farmer responses).

Codes	PLL		No PLL		Total responses	
	No.	(%)	No.	(%)	No.	(%)
1. OFWM officials must be honest and co-operative with farmers; should provide more technical guidance and do better surveying work; should come and do PLL work on time (when requested) and work quickly; should not refuse to PLL plots less than 4-5 acres; should not ignore/discriminate against small farmers	26	(19)	33	(24)	59	(22)
2. Tractor and/or operator should be made available from OFWM at a low rate (lower than private rental ones).	24	(18)	24	(18)	48	(18)
3. Subsidy should be increased to coincide more with the actual costs of PLL; subsidy should be paid for the loss of crop(s); for decrease in yield during the first cropping season after PLL (in the form of cash or chemical fertilizer); for repairing the tractor after the great strain put on it by PLL work; for the loss of trees.	23	(17)	22	(16)	45	(16)
4. OFWM should make the full details about the PLL program and subsidy easily known to all farmers; call a meeting in villages to explain the PLL program to all the farmers; OFWM should make more efforts in approaching farmers and explaining the PLL program to them.	8	(6)	25	(18)	33	(12)
5. Smaller farmers should get more subsidy than the larger ones; advance subsidy should be made available (especially for small farmers).	6	(4)	12	(9)	18	(7)
6. Payment of OFWM implements should not be demanded in advance; rent for implements should not be subtracted from the subsidy check; farmers should not be charged rent for the implements on the days when they are not being used; the implements should be kept in working order; farmers should not be sent to bring the implements lying elsewhere but OFWM should arrange to bring them; the implements should be more easily available (less delay).	13	(9)	3	(2)	16	(6)

Table 31. Farmer suggestions - (sum of farmer responses)(continued).

Codes	PLL		No PLL		Total responses	
	No.	(%)	No.	(%)	No.	(%)
7. Subsidy check should be made easier to get cashed from the bank.	13	(9)	3	(2)	16	(6)
8. Make bulldozers available for PLL work.	8	(6)	3	(2)	11	(4)
9. OFWM equipment rental rates should be decreased.	6	(4)	3	(2)	9	(3)
10. Subsidy check should be made easier to get from OFWM.	5	(4)	1	(1)	6	(2)
11. Credit should be made easily available for PLL.	2	(1)	4	(3)	6	(2)
12. PLL and W/C improvement should be made compulsory in all villages; OFWM should have legal power for PLL and W/C improvement; PLL should be done by OFWM and then farmer should be charged afterwards, after the subsidy is given to the farmers.	2	(1)	1	(1)	3	(1)
13. Bullock-drawn scrapers should be developed and made accessible; private PLL agencies should be established and encouraged.	0	(0)	2	(1)	2	(1)
14. Acreage limit of 5 acres for PLL with subsidy should be increased (or removed entirely).	1	(1)	0	(0)	1	(0)
15. Land should be consolidated before PLL program.	0	(0)	1	(1)	1	(0)

PLL/No PLL vs. Suggestions: $\chi^2 = 35.050$ 14df s.i. = .001

The most popular suggestions made by both PLL and No PLL farmers were that (1) OFWM officials and employees should be more honest and cooperative with farmers and that they should not discriminate against small farmers; (2) tractor and/or operators should be made available from OFWM at rates lower than private (village) rental rates; (3) the subsidy should be increased to coincide more with the actual (total or real) costs of PLL, especially with regard to the income lost from crops as a result of PLL and loss of the first cropping season; (4) OFWM should make more effort to seek out and explain the full details of the program to farmers; (5) small farmers should be granted larger (and/or advance) subsidies than large farmers, (6) the rental payments for OFWM implements should not be demanded in advance, the rent should not be subtracted from the subsidy check, rent should not be charged when the implements are not in use, and the implements should be more plentiful and easily available, and (7) the subsidy check should be made easier to get cashed from the bank.

The above suggestions reflect the farmers' perceived needs or preferences. Some of them, such as the need for OFWM staff to avoid discrimination against small farmers, the need for OFWM personnel to seek out and explain the full details of the program to farmers, availability of implements, and especially the need for changes in the check cashing procedure can be endorsed without qualification.

Others, such as reduced tractor rates or changes in subsidy rates for small farmers, require much more careful consideration. It probably is not practical from an administrative standpoint to give an extra subsidy by supplying tractors at reduced rates. If subsidies are insufficient to attract small farmers, consideration should probably be given to increased direct subsidies rather than the indirect subsidies of tractor rentals at less than cost. Partial compensation for crops lost is worthy of consideration.

VI. SUMMARY, RECOMMENDATIONS AND CONCLUSIONS

In this report it has been demonstrated that there are many constraints on small farmers in the PLL program. The category of No PLL farmers (those who were to some degree aware of the program but either chose not to or were unable to participate in the program) was shown to be different in many respects from PLL farmers, and perceived different types of problems and constraints. No PLL farmers interviewed tend to own and operate smaller farms than PLL farmers, to be less educated, possess more fragmented land holdings, sell or trade considerably less of their farm produce on the market (i.e., are more subsistence farmers), and own considerably fewer tractors and tubewells. Many of these differences are probably related to the fact that farm ownership size of PLL farmers as reported to us was larger than that reported on OFWM records. Thus, the PLL farmers sampled were larger than the No PLL farmers sampled. The farmers who did not participate in PLL are also more likely to hear about the PLL program through second- and third-hand sources (instead of from OFWM Personnel directly). They are more likely to mistrust OFWM personnel and government people in general, to be unaware of the full details of the PLL program, and to be opposed to credit facilities for PLL. Their major perceived constraints, in order of importance, are (1) loss of a cropping season and double cropping of land, i.e., no available land for PLL, (2) a lack of knowledge about the PLL program and not being convinced of the benefits of PLL, (3) tractor and/or implement rental is too costly, (4) a mistrust of OFWM and a feeling that the reputation of OFWM workers is not good, (5) the rate of subsidy is too low, and (6) a lack of approach to OFWM.

At this point, the author would like to make some subjective and personal observations which may help to put some of the findings of the survey in better perspective. Even though we are unable to say definitively that PLL farmers tend to be larger than No PLL farmers in terms of farm size, due to unfortunate sampling difficulties, we (the researchers) feel that this is a true statement. In several village areas we found a relative abundance of No PLL farmers in the very small category, but were hard put to locate and interview even one PLL farmer in the small category (ownership acreage size between 12.5 and 25 acres). Large No PLL farmers were extremely rare in those areas visited where PLL work had been done. It was our subjective finding that PLL farmers tended to be larger, more educated, less fragmented, less subsistence oriented, more wealthy, more influential, and more progressive than No PLL farmers. We found that OFWM personnel tend to cater to the needs of the larger and more influential farmers for PLL, but that all farmers had a good opinion of the OFWM people and the type of work they do. The reputation of OFWM is considerably higher than that of any other government agency which works extensively with farmers. We found the farmers in the Chiniot area very difficult to interview and deal with, and we sympathize with the problems faced by the A.T.O. in that area. We found almost all the No PLL farmers genuinely interested in finding out more about both the PLL and watercourse improvement programs.

The major benefits of PLL as perceived by farmers are (1) reduced time to irrigate (less water per acre), (2) better crop production and higher yield, (3) easier operation of tractor and equipment (increase in plot size) and more effective utilization of modern agricultural equipment, (4) reduction in hired labor costs, (5) improvement of status, and (6) reduction in family labor time. The major perceived costs of PLL

are, in order of importance, (1) tractor fuel and labor time, (2) tractor rental, (3) getting the subsidy check cashed from the bank, (4) OFWM equipment rental, (5) hired labor costs, and (6) loss of a cropping season. The subsidy averaged approximately one-half of the direct costs of PLL, but only about one-third of the total costs. The indirect costs of PLL were larger than expected--about half the average direct costs of PLL.

Farmers' suggestions generally fell into two classes, those requesting increased subsidies of one type or another, and those relating to the need for OFWM personnel to be more effective in contacting farmers and explaining the program.

This author is of the personal opinion that the PLL program is an excellent program, and that with several modifications will continue to raise agricultural productivity and promote the more efficient use of limited supplies of water throughout the Punjab province. It is hoped that with modification the program will be able to more effectively reach the small and very small farmers.

Farmers seem generally willing and anxious to avail themselves of more (future) PLL, even though most of them do not, of course, qualify for future subsidies unless they are able to somehow subdivide more of their land holdings in the names of other family relations.

In addition to the suggestions made by surveyed farmers themselves, this author would like to make the following recommendations:

1. Since the project is aimed at the small farmer, considerable more effort should be made to determine precise ownership acreages. OFWM should be given access to all land ownership records (i.e., from the Revenue Department) and have the legal power to obtain such records at any time. No attention should be given at this time to operational size

of holdings since this will no doubt prove very difficult and time consuming for OFWM to verify. As was recognized earlier in this report, OFWM has experienced great difficulty in verifying ownership acreages, and consequently has tended to merely accept farmer's testimonies. In the face of the time-consuming verification process, this policy is certainly reasonable. However, if extensive effort is to be made to reach small farmers and insure that only they participate in the cost-sharing program, a reevaluation of the present policy with more emphasis being given to the verification process is in order.

2. More effort should be made by OFWM to reach and inform all farmers and especially small farmers about the full details of the PLL project. This pertains also to the improvement of watercourses. It is to be expected that the larger, more educated and more "progressive" farmers will usually be the first ones in a village or chak to seek out the OFWM people in order to elicit more details about the program and to make the actual decision to do some precision land leveling. OFWM is correct in going to assist in the PLL work of these farmers and in granting them a subsidy if they so qualify. However, there is no reason why the OFWM workers cannot make attempts to, for example, call a general meeting in the village or chak where they have gone to do PLL work, in which they can effectively explain the PLL program including its benefits and costs, to at least those farmers who were interested enough to attend such a meeting. Several meetings may have to be held, upon request, in order to reach all interested farmers. At the conclusion of these meetings, efforts should be made by the OFWM teams to level the lands of all those who have completed an application form for PLL in one particular village area, before proceeding to other village areas.

There should be no discrimination against small farmers who have expressed the desire for PLL and completed an application form. Because of PLL target goal stipulations, many OFWM officers are tempted to give more consideration to those farmers who are willing to level more acres, and to give less consideration to small farmers who wish to level less than four or five acres. While there are problems with the target-goal procedure, there would probably be more serious problems without it, since without target goals there would be little or no incentive for OFWM personnel to perform PLL work.

3. Since the demand for PLL is greater than the supply of PLL teams and equipment and the demand will increase further with more attempts of OFWM to reach small farmers; more personnel, implements, and training should be made available for PLL work. It is only by adequately meeting the demand of all farmers for PLL that the small farmer will be attended to and benefited. When the demand exceeds the supply, the tendency is for larger, more influential farmers to benefit more than smaller, less influential farmers.

4. The rate of subsidy (based upon the volume of earth moved as determined by surveying techniques) should be higher for "very small" farmers than for "small" farmers (author's definitions of very small and small). This would effectively allow for smaller farmers to overcome their major constraints of losing a cropping season due to PLL and not being able to afford the costly rental of tractors. If feasible, an advance subsidy should be offered to very small farmers. If this is not feasible, then credit arrangements should be made easily available for PLL. This could be implemented in addition to the granting of advance subsidies. The authors do not feel that additional subsidies should be

granted for the decrease in yield resulting during the first cropping season after PLL (in the form of cash or chemical fertilizer), nor for repairing tractors owned by farmers after the great strain put on them by the PLL work, nor for the loss of trees uprooted as a prerequisite of PLL work, since these are not among the major constraints on farmers in the PLL program.

5. The procedure of getting subsidy checks cashed must be simplified. Over and over again this was a major complaint we heard from farmers about the program. The OFWM personal ledger accounts (P.L.A.) used for the payment of subsidies should be operated exclusively through private banks, instead of the current procedure of all subsidy checks being required to go to the Revenue Department for approval and release of funds.

6. To coincide with attempts to reach all farmers, and especially smaller farmers, more efforts should be made to develop and make available bullock-drawn scrapers, since tried and tested bullock power and labor intensive technologies may appeal more to very small farmers than tractor power and capital intensive technologies. The establishment and encouragement of private agencies and contractors to perform PLL would tend to ease the pressure on existing OFWM teams to service the demands of all farmers. Private agencies could concentrate on servicing both those farmers who do not qualify for a government subsidy and those farmers who prefer not to be dependent on OFWM for PLL. Such private agencies could be encouraged at first by tax incentives and by OFWM advertising the existence of private services in areas where they are doing PLL work.

Effective implementation of these recommendations will not only improve the quality of the existing PLL program, but will also serve to more effectively reach and benefit small farmers, in addition to larger

farmers who have been in the past the principal recipients of the benefits of the PLL program. There have been difficulties with the program in reaching and benefiting the target group of small farmers. However, any program designed to reach and benefit small farmers will undoubtedly encounter similar difficulties. With this in mind, it would be a mistake to misinterpret the criticisms and shortcomings of the program or to suspend or terminate the program due to these problems. The current PLL program is in a critical phase: it is beginning to gain recognition and acceptance in many village areas, and with some modifications it can not only continue to gain popularity but can also better reach the targeted group of farmers. Suspension or termination of the program at this phase would strike a major blow to farmers in general, OFWM morale, and to the other (future) development programs aimed at small farmers in Pakistan.

Appendix A

Appendix Tables

Table A1. Number, size, and location of PLL parcels with respect to position on the watercourse (PLL only).

Parcel Size (Acres)	Improved Watercourse				Unimproved Watercourse				Total			
	Head	Mid-	Tail	To-	Head	Mid-	Tail	To-	Head	Mid-	Tail	To-
	No.	No.	No.	tal No.	No.	No.	No.	tal No.	No.	No.	No.	tal No.
0 - 5	8	9	2	19	6	7	10	23	14	16	12	42
More than 5	2	2	3	7	3	13	6	22	5	15	9	29
Total	10		5	26	9	20	16	45	19	31	21	71

Parcel Size vs. Position on W/C:	$\chi^2=2.425$	2df	s.l.=.50 (NS)
Type of W/C vs. Parcel Size:	$\chi^2=2.444$	1df	s.l.=.50 (NS)
Type of W/C vs. Position on W/C:	$\chi^2=3.601$	2df	s.l.=.25 (NS)
Type of W/C vs. Parcel Size & Position on W/C:	$\chi^2=5.593$	2df	s.l.=.10

Table A2. Farmers' status (PLL vs. No PLL) - Column Percentages.

Status category	PLL			No PLL		
	Faisal. No. (%)	Sahiwal No. (%)	Total No. (%)	Faisal. No. (%)	Sahiwal No. (%)	Total No. (%)
Full time	23 (77)	22 (73)	45 (75)	22 (73)	24 (80)	46 (77)
Part time	7 (23)	8 (27)	15 (25)	8 (27)	6 (20)	14 (23)
Total	30 (100)	30 (100)	60 (100)	30 (100)	30 (100)	60 (100)

PLL/No PLL vs. farmer status:	$\chi^2=0.000$	1df	s.l.=1.00 (NS)
Farmer status vs. C.O.:	$\chi^2=0.000$	1df	s.l.=1.00 (NS)
PLL/No PLL vs. farmer status vs. C.O.:	$\chi^2=0.048$	1df	s.l.=.90 (NS)

Table A3. Actual degree of OFWM participation and farm size (PLL only) - Corner Percentages.

	Code 1		Code 2		Code 3		Code 4		Total	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)
Ownership size										
Very small	1	(2)	12	(20)	1	(2)	3	(5)	17	(28)
Small	2	(3)	27	(45)	2	(3)	1	(2)	32	(53)
Large	0	(0)	11	(18)	0	(0)	0	(0)	11	(18)
Total	3	(5)	50	(83)	3	(5)	4	(7)	60	(100)
Operational size										
Very small	0	(0)	1	(2)	0	(0)	3	(5)	4	(7)
Small	2	(3)	13	(22)	3	(5)	1	(2)	19	(32)
Large	1	(2)	36	(60)	0	(0)	0	(0)	37	(62)
Total	3	(5)	50	(83)	3	(5)	4	(7)	60	(100)

- Codes: 1. OFWM provides tractor with implements, surveying, & technical guidance.
 2. OFWM provides PLL implements, surveying and technical guidance (no tractor).
 3. OFWM provides technical guidance only.
 4. Farmer arranges for PLL work privately, OFWM does a final inspection only, and if approved subsidy is granted.

Ownership size vs. Degree of OFWM participation: $\chi^2 = 6.465$ 6df
 s.l. = .50 (NS)

Operational size vs. Degree of OFWM participation: $\chi^2 = 41.770$ 6df
 s.l. = .001

Table A4. Actual degree of OFWM participation and educational level
(PLL only) - Corner Percentages.

	Code 1		Code 2		Code 3		Code 4		Total	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)
None	1	(2)	4	(7)	3	(5)	2	(3)	10	(17)
Primary + Matric.	1	(2)	30	(50)	0	(0)	1	(2)	32	(53)
Above Matric.	1	(2)	16	(27)	0	(0)	1	(2)	18	(30)
Total	3	(5)	50	(83)	3	(5)	4	(7)	60	(100)

Education vs. Degree of OFWM participation: $\chi^2 = 21.775$ 6df s.l. = .001

Table A5. Actual degree of OFWM participation and tractor ownership
(PLL only) - Corner Percentages.

	Code 1		Code 2		Code 3		Code 4		Total	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)
0	2	(3)	11	(18)	3	(5)	3	(5)	19	(32)
1+	1	(2)	39	(65)	0	(0)	1	(2)	41	(68)
Total	3	(5)	50	(83)	3	(5)	4	(7)	60	(100)

Tractor ownership vs. Degree of OFWM participation: $\chi^2 = 13.802$ 3df
s.l. = .01

Table A6. Days to start PLL work and farm size (PLL only) - Corner Percentages.

	1 week or less		1-2 weeks		2-4 weeks		More than 4 weeks		Total	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)
<u>Ownership</u>										
<u>Size</u>										
Very small	10	(18)	4	(7)	2	(4)	0	(0)	16	(29)
Small	23	(41)	4	(7)	1	(2)	1	(2)	29	(52)
Large	10	(18)	0	(0)	1	(2)	0	(0)	11	(20)
Total	43	(77)	8	(14)	4	(7)	1	(2)	56	(100)
<u>Operational</u>										
<u>Size</u>										
Very small	1	(2)	1	(2)	1	(2)	0	(0)	3	(5)
Small	13	(23)	4	(7)	1	(2)	0	(0)	18	(32)
Large	29	(52)	3	(5)	2	(4)	1	(2)	35	(63)
Total	43	(77)	8	(14)	4	(7)	1	(2)	56	(100)
Ownership size vs. days to start PLL work:					$\chi^2=5.784$	6df	s.l.=.50 (NS)			
Operational size vs. days to start PLL work:					$\chi^2=6.955$	6df	s.l.=.50 (NS)			

Table A7. Duration of PLL work (PLL only) - Row Percentages.

	1-7 days No. (%)	8-25 days No. (%)	More than 25 days No. (%)	Total No. (%)
Faisalabad	5 (24)	12 (57)	4 (19)	21 (100)
Sahiwal	4 (13)	15 (50)	11 (37)	30 (100)
Total	9 (18)	27 (53)	15 (29)	51 (100)

Duration of PLL work vs. C.O.: $\chi^2=2.191$ 2 df s.l. = .50 (NS)

Table A8. Duration of PLL work and farm size (ownership and operation) - Corner Percentages.

	1-7 days No. (%)	8-25 days No. (%)	More than 25 days No. (%)	Total No. (%)
<u>Ownership size</u>				
Very small	1 (2)	6 (12)	4 (8)	11 (22)
Small	8 (16)	15 (29)	7 (14)	30 (59)
Large	0 (0)	6 (12)	4 (8)	10 (20)
Total	9 (18)	27 (53)	15 (29)	51 (100)
<u>Operational size</u>				
Very small	0 (0)	1 (2)	0 (0)	1 (2)
Small	3 (6)	8 (16)	3 (6)	14 (27)
Large	6 (12)	18 (35)	12 (24)	36 (71)
Total	9 (18)	27 (53)	15 (29)	51 (100)

Duration of PLL work vs. ownership size: $\chi^2=4.691$ 4df s.l.=.50 (NS)

Duration of PLL work vs. operational size: $\chi^2=1.619$ 4df s.l.=.90 (NS)

Table A9. Duration of PLL work and PLL acreages - Corner Percentages.

PLL acreages	1-7 days No. (%)	8-25 days No. (%)	More than 25 days No. (%)	Total No. (%)
0 - 5	5 (10)	14 (27)	3 (6)	22 (43)
Greater than 5	4 (8)	13 (25)	12 (24)	29 (57)
Total	9 (18)	27 (53)	15 (29)	51 (100)

Duration of PLL work vs. PLL acreage: $\chi^2=4.675$ 2df s.l.=.10

Table A10. Main reasons for not doing PLL and farm size - ownership and operational (No PLL only) (total responses).

Code	Ownership Size				Operational Size			
	Very Small No.	Small No.	Large No.	Total No.	Very Small No.	Small No.	Large No.	Total No.
Land double cropped (no available land); loss of one cropping season	24	18	2	44	18	13	13	44
Fields level enough; not convinced of its benefits; lack of knowledge; only recently came to know about PLL program; simply not interested (with no particular explanation); land can be leveled by self; laziness; too busy for PLL	20	19	2	41	12	19	10	41
Tractor and/or implement rental too costly/not available	21	16	0	37	18	12	7	37
Mistrust of OFWM (and govt. people in general); reputation of OFWM workers for doing job properly, on time, and when requested is not good	14	8	0	22	9	9	4	22
Rate of subsidy too low	10	8	0	18	9	6	3	18
Lack of approach to OFWM	14	4	0	18	7	7	4	18
Total	103	73	4	180	73	66	41	180

Main reasons for not doing PLL vs. Ownership size (VS,S,L):

$$\chi^2 = 8.604 \quad 10df \quad sl. = .90 \quad (NS)$$

Main reasons for not doing PLL vs. Ownership size (VS&S):

$$\chi^2 = 4.823 \quad 5df \quad sl. = .50 \quad (NS)$$

Main reasons for not doing PLL vs. Operational size:

$$\chi^2 = 5.994 \quad 10df \quad sl. = .90 \quad (NS)$$

Table All. Main reasons for not doing PLL and degree of cash farming
(% crops sold)(total responses)(No PLL only) - Corner
Percentages.

Code	0-50% No. (%)	50-100% No. (%)	Total No. (%)
Land double cropped (no available land); loss of one cropping season	18 (10)	24 (14)	42 (24)
Field level enough; not convinced of its benefits; lack of knowledge; only recently came to know about PLL program; simply not interested (with no particular ex- planation); land can be leveled by self; laziness; too busy for PLL	17 (10)	20 (11)	37 (21)
Tractor and/or implement rental too costly/not available	19 (11)	18 (10)	37 (21)
Mistrust of OFWM (and govt. people in general); reputation of OFWM workers for doing job properly, on time, and when requested is not good	8 (5)	14 (8)	22 (13)
Rate of subsidy too low	9 (5)	9 (5)	18 (10)
Lack of approach to OFWM	12 (7)	6 (3)	18 (10)
Total	83 (48)	91 (52)	174 (100)

Main reasons for not doing PLL vs. Degree of cash farming:

$$\chi^2 = 4.405 \quad 5df \quad s.l. = .50 \text{ (NS)}$$

Table A12. Main reasons for not doing PLL and education level (total responses)(No PLL only) - Corner Percentages.

Code	None		Primary & Matric		Above Matric		Total	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
Land double cropped (no available land); loss of one cropping season	17	(10)	22	(12)	3	(2)	42	(24)
Fields level enough; not convinced of its benefits; lack of knowledge; only recently came to know about PLL program; simply not interested (with no particular explanation); land can be leveled by self, laziness; too busy for PLL	13	(3)	26	(14)	2	(1)	41	(23)
Tractor and/or implement rental too costly/not available	12	(7)	24	(13)	1	(1)	37	(21)
Mistrust of OFWM (and govt. people in general); reputation of OFWM workers for doing job properly, on time, and when requested is not good	10	(6)	10	(6)	2	(1)	22	(12)
Rate of subsidy too low	5	(3)	12	(7)	0	(0)	17	(10)
Lack of approach to OFWM	10	(6)	9	(5)	0	(0)	19	(11)
Total	67	(38)	103	(58)	8	(4)	178	(100)

Main reasons for not doing PLL vs. Education: $\chi^2 = 8.295$ 10df
 s.l. = .90 (NS)

Table A13. Main reasons for not doing PLL and type of watercourse (total responses) (No PLL only) - Corner Percentages.

Code	Improv. W.C.		Unimprov. W.C.		Improv. & Unimp. W.C.		Total	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
Land double cropped (not available land); loss of one cropping season	11	(7)	27	(16)	2	(1)	40	(24)
Fields level enough; not convinced of its benefits; lack of knowledge; only recently came to know about PLL program; simply not interested (with no particular explanation); land can be leveled by self; laziness; too busy for PLL	10	(6)	29	(17)	0	(0)	39	(23)
Tractor and/or implement rental too costly/not available	4	(2)	26	(15)	2	(1)	32	(19)
Mistrust of OFWM (and govt. people in general); reputation of OFWM workers for doing job properly, on time, and when requested is not good	4	(2)	17	(10)	0	(0)	21	(12)
Rate of subsidy too low	3	(2)	13	(8)	1	(1)	17	(10)
Lack of approach to OFWM	6	(4)	14	(8)	0	(0)	20	(12)
Total	38	(22)	126	(75)	5	(3)	169	(100)

Main reasons for not doing PLL vs. Type of watercourse: $\chi^2 = 8.061$ 10df
s.l. = .90 (NS)

Table A14. Main reasons for not doing PLL and tractor ownership (total responses) (No PLL only) - Corner Percentages.

Code	0		1+		Total	
	No.	(%)	No.	(%)	No.	(%)
Land double cropped (no available land); loss of one cropping season	35	(20)	7	(4)	42	(23)
Fields level enough; not convinced of its benefits; lack of knowledge; only recently came to know about PLL program; simply not interested (with no particular explanation); land can be leveled by self; laziness; too busy to PLL	35	(20)	7	(4)	42	(23)
Tractor and/or implement rental too costly/not available	34	(19)	2	(1)	36	(20)
Mistrust of OFWM (and govt. people in general); reputation of OFWM workers for doing job properly, on time, and when requested is not good	15	(8)	7	(4)	22	(12)
Rate of subsidy too low	17	(9)	1	(1)	18	(10)
Lack of approach to OFWM	17	(9)	2	(1)	19	(11)
Total	153	(85)	26	(15)	179	(100)

Main reasons for not doing PLL vs. Tractor ownership: $\chi^2 = 9.353$ 5df
s.l. = .10

Table A15. Main reasons for not doing PLL and percentage of water needs met in Rabi and Kharif (total responses)(No PLL only) - Corner Percentages.

Code	Total of Rabi & Kharif		
	0-75%	76%-100%	Total
	No. (%)	No. (%)	No. (%)
Land double cropped (no available land); loss of one cropping season	29 (8)	55 (15)	84 (23)
Fields level enough; not convinced of its benefits; lack of knowledge; only recently came to know about PLL program; simply not interested (with no particular explanation); land can be leveled by self; laziness; too busy for PLL	39 (11)	43 (12)	82 (23)
Tractor and/or implement rental too costly/ not available	34 (9)	40 (11)	74 (21)
Mistrust of OFWM (and govt. people in general); reputation of OFWM workers for doing job properly, on time, and when requested is not good	17 (5)	27 (8)	44 (12)
Rate of subsidy too low	9 (3)	27 (8)	36 (10)
Lack of approach to OFWM	22 (6)	16 (4)	38 (11)
Total	150 (42)	208 (58)	358 (100)

Main reasons for not doing PLL vs. percent of water needs met: $\chi^2 = 11.864$
5 df s.l. = .05

Appendix B

English Questionnaire

I.D. No. _____

Questionnaire No. _____

QUESTIONNAIRE FOR FARMERS WHO HAD PLL

		<u>Code</u>
I.	A. OFWM Coordinator Office 1. Faisalabad 2. Sahiwal	A _____
	B. OFWM Area Team Office 1. Jaranwala 2. Toba Tek Singh 3. Chiniot 4. Sahiwal 5. Chichawatni 6. Khanewal	B _____
	C. PLL Participation 1. Have had PLL done 2. Aware of PLL but have not had PLL done	C _____
	D. Categorization of respondent farmer 1. Very small (less than 12.5) 2. Small (12.5-25) 3. Large (more than 25)	D _____
II.	A. Interviewer _____ Date _____	A _____
	B. District _____	B _____
	C. Tehsil _____	C _____
	D. Village or Chak _____	D _____
III.	A. Farmer's name _____ Father's Name _____	
	B. Education 1. None 2. Primary (1-5) 3. Middle/Matric (6-10) 4. Above Matric	B _____
IV.	A. Total area owned (acres)	A _____
	B. Total area operated but not owned (acres)	B _____
	C. Total area rented (acres)	C _____
	D. Total operated area (this village and elsewhere) (Sum of A, B, and C)	D _____
V.	A. Distance from village or chak to OFWM office (miles) (to be filled in by interviewer)	A _____
	B. Distance of village or chak from nearest pakka road (miles)	B _____

C. Total Watercourses in village area

1. Number of improved	C1	_____
2. Number of partially improved	C2	_____
3. Number of unimproved	C3	_____
4. Total	C4	_____

D. Number of parcels with location:

	No. of Parcels		
	Improved WC	Unimproved WC	Total
1. $\frac{1}{2}$ acre or less	D1a	D1b	D1c
2. $\frac{1}{2}$ - 1 acre	D2a	D2b	D2c
3. 1 - 5 acres	D3a	D3b	D3c
4. More than 5 acres	D4a	D4b	D4c
5. Total	D5a	D5b	D5c

E. Total areas PLL

1. According to farmer	
a. Total acres PLL	E1 _____
b. How much money did you pay to level your land? (Direct Costs: See Page E5 sum of costs 1-5).	E2 _____
c. How much did OFWM pay for PLL? (Rupees) (Subsidy amount)	E3 _____
2. According to OFWM records	
d. Total acres PLL	E4 _____
e. Total acres cost shared	E5 _____
f. Total acres owned	E6 _____

F. Number and location of PLL Parcels on Improved WC

Acreage	Position on WC			Total
	Head	Middle	Tail	
1. $\frac{1}{2}$ acre or less	F1a	F1b	F1c	F1d
2. $\frac{1}{2}$ - 1 acre	F2a	F2b	F2c	F2d
3. 1 - 5 acres	F3a	F3b	F3c	F3d
4. More than 5 acres	F4a	F4b	F4c	F4d
5. Total	F5a	F5b	F5c	F5d

G. Number and location of PLL Parcels on Unimproved WC

Acreage	Position on WC			Total
	Head	Middle	Tail	
1. $\frac{1}{2}$ acre or less	G1a	G1b	G1c	G1d
2. $\frac{1}{2}$ - 1 acre	G2a	G2b	G2c	G2d
3. 1 - 5 acres	G3a	G3b	G3c	G3d
4. More than 5 acres	G4a	G4b	G4c	G4d
5. Total	G5a	G5b	G5c	G5d

H. Percentage of Kharif and Rabi crops sold or traded
(including fruits and vegetables) % of crop sold

<u>Crop</u>	
1. Wheat	H1 _____
2. Rice	H2 _____
3. Sugarcane	H3 _____
4. Corn (Maize)	H4 _____
5. Cotton	H5 _____
6. Fodder	H6 _____
7. Vegetables	H7 _____
8. Fruits	H8 _____
9. All others	H9 _____
10. Total	H10 _____

I. Farmer Status I _____
Code: 1. Full-time 2. Part-time

J. Percentage of family income from farm J _____
Code: 1. 100% 2. 50-99% 3. 25-49% 4. less than 25%

K. Number of tractors owned and/or jointly owned K _____

L. From where do you get your water supply? L _____
Code: 1. Canal only; 2. own tubewell (TW) only;
3. purchase TW water only; 4. canal plus own TW;
5. canal plus purchase TW; 6. Own TW plus purchase
TW; 7. Canal plus own TW plus purchase TW;
8. Other (specify).

M. Do you get enough water for your crops each season?
1. Rabi Season M1 _____
2. Kharif Season M2 _____
Code: 1. 25% or less 2. 26-50% 3. 51-75% 4. 76-100%

VI. A. How did you first hear about PLL? A1 _____
Code: A2 _____
0. Not applicable/no response A3 _____
1. From fellow villagers, friends, relatives,
etc., in this village.
2. From someone outside this village (aside from
OFWM or Government agencies).
3. Was approached by an OFWM person.
4. Happened to meet an OFWM person.
5. Saw the OFWM office sign and inquired within.
6. Witnessed PLL work in progress.
7. Radio, TV, other advertisement.
8. Approached OFWM office.
9. From other government person.

- B. What arrangements were made between you and OFWM to get your land precision leveled? B _____

Code:

1. OFWM provides tractor with implements, surveying equipment, and technical guidance.
2. OFWM provided PLL implements and technical guidance (no tractor)
3. OFWM provides technical guidance only
4. Farmer arranges for PLL work privately, and OFWM does the final inspection only, and if approved, subsidy is granted.

- VII. A. What benefits were you expecting to receive from PLL? (or) Why did you get your PLL? A1 _____

1. Most important benefit/reason A2 _____
2. Second most important A3 _____
3. Third most important A4 _____

Code:

1. Better crop production (higher yields) A5 _____
2. Increase in cropping intensity
3. To reclaim waste or defective land
4. Reduced time to irrigate (less water per acre)
5. Easier operation of tractor and equipment (increase in plot size)
6. Easier operation of bullocks and equipment (increase in plot size)
7. Reduction in family labor time
8. Reduction in hired labor costs
9. Improvement of status
10. Other (specify) _____

- B. How long did it take for the OFWM team to start PLL work on your land? B _____

- C. How many days did it take (OFWM) to complete the PLL work? C _____

- D. Degree of participation of OFWM in PLL work D _____

Code:

1. OFWM provided tractor, implements, and technical guidance.
2. OFWM provided only implements and guidance (not tractor).
3. OFWM provided only technical guidance.
4. OFWM did final inspection only.

E. Implements used for PLL and source of each

<u>Implements</u>	<u>Number</u>	<u>Source</u>
1. Tractor	E1a _____	E1b _____
2. Blade (land plane)	E2a _____	E2b _____
3. Scraper	E3a _____	E3b _____
4. Krah (bullock)	E4a _____	E4b _____
5. Chisel Plow	E5a _____	E5b _____
6. Disc (ridger)	E6a _____	E6b _____
7. Bulldozer	E7a _____	E7b _____

Code: (for sources)

0. None/not applicable 1. Own 2. Private rental
 3. OFWM or other Government agency rental
 4. Own and private rental 5. Own and OFWM rental
 6. Private and OFWM 7. Own and private and OFWM

F. What benefits did you actually realize after PLL?

1. Most important benefit F1 _____
 2. Second most important F2 _____
 3. Third most important F3 _____

Code:

0. No benefit/not applicable F4 _____
 1. Better crop production (higher yields) F5 _____
 2. Increase in cropping intensity
 3. Reclaim waste or defective land
 4. Reduced time to irrigate (less water per acre)
 5. Easier operation of tractor and equipment
 (increase in plot size)
 6. Easier operation of bullocks and equipment
 (increase in plot size)
 7. Reduction in family labor time
 8. Reduction in hired labor costs
 9. Improvement of status
 10. Other (specify) _____

G. What main costs and/or difficulties did you encounter in PLL (during and after)?

1. Most important cost to farmer G1 _____
 2. Second most important G2 _____
 3. Third most important G3 _____

Code:

0. No cost/not applicable
 1. Only tractor fuel and labor time (Rs.) _____
 2. Tractor Rental (Rs.) _____
 3. OFWM equipment rental (Rs.) _____
 4. Equipment from private sources (Rs.) _____
 5. Hired labor costs (Rs.) _____

Direct
Costs

G. Costs (continued)

Indirect costs	6. Cost of entertaining OFWM officials (Rs.) _____	
	7. Kickbacks to OFWM (Rs.) _____	
	8. OFWM takes too long to come to do the PLL work.	
	9. Difficulty in getting subsidy check from OFWM (Rs.) _____	
	10. Difficulty in getting subsidy check cashed from bank (Rs.) _____	
	11. Loss of a cropping season (Rs.) _____	
	12. Maintenance costs of keeping land level (Rs.) _____	
	13. All others (Rs.) _____	
	14. Total (Rs.) _____	G4 _____

H. Are you interested in getting more PLL? H _____
 0. Not applicable 1. Yes 2. No.

I. If no, why not? I1 _____
 1. Most important reason I2 _____
 2. Second most important I3 _____
 3. Third most important

J. Also, if no, what would encourage you to adopt more PLL?
 1. Most important condition J1 _____
 2. Second most important J2 _____
 3. Third most important J3 _____

VIII. A. If you were to ever utilize more PLL, then from which source would you prefer to have your land PLL? A _____
 Code: 0. Not applicable 1. Self 2. private source
 3. OFWM 4. self and private 5. self and OFWM
 6. private and OFWM 7. self and private and OFWM

IX. Credit availability and arrangements for PLL A _____

X. Extension service (field inspection) after PLL B _____

XI. Suggestions C _____

A _____
 B _____
 C _____
 D _____
 E _____

I.D. No. _____

Questionnaire No. _____

QUESTIONNAIRE FOR FARMERS WHO HAVE NOT HAD PLL (No PLL)

		<u>Code</u>
I.	A. OFWM Coordinator Office	A _____
	1. Faisalabad 2. Sahiwal	
	B. OFWM Area Team Office	B _____
	1. Jaranwala 2. Toba Tek Singh 3. Chiniot	
	4. Sahiwal 5. Chichawatni 6. Khanewal	
	C. PLL Participation	C _____
	1. Have had PLL done	
	2. Aware of PLL but have not had PLL done	
	D. Categorization of respondent farmer	D _____
	1. Very small (less than 12.5) 2. Small (12.5-25)	
	3. Large (more than 25)	
II.	A. Interviewer _____ Date _____	A _____
	B. District _____	B _____
	C. Tehsil _____	C _____
	D. Village or Chak _____	D _____
III.	A. Farmer's Name _____ Father's Name _____	
	B. Education	B _____
	1. None 2. Primary (1-5) 3. Middle/Matric (6-10)	
	4. Above Matric	
IV.	A. Total area owned (acres)	A _____
	B. Total area operated but not owned (acres)	B _____
	C. Total area rented (acres)	C _____
	D. Total operated area (this village and elsewhere) (sum of A, B, and C)	D _____
V.	A. Distance from village or chak to OFWM office (miles) (to be filled in by interviewer)	A _____
	B. Distance of village or chak from nearest pakka road (miles)	B _____
	C. Total watercourses in village area	
	1. Number of improved	C1 _____
	2. Number of partially improved	C2 _____
	3. Number of unimproved	C3 _____
	4. Total	C4 _____

D. Number of parcels with location:

Acreage	No. of Parcels		Total
	Improved WC	Unimproved WC	
1. ½ acre or less	D1a _____	D1b _____	D1c _____
2. ½ - 1 acre	D2a _____	D2b _____	D2c _____
3. 1 - 5 acres	D3a _____	D3b _____	D3c _____
4. More than 5 acres	D4a _____	D4b _____	D4c _____
5. Total	D5a _____	D5b _____	D5c _____

E. Percentage of Kharif and Rabi crops sold or traded
(including fruits and vegetables)

Crop	% of crop sold
1. Wheat	E1 _____
2. Rice	E2 _____
3. Sugarcane	E3 _____
4. Corn (Maize)	E4 _____
5. Cotton	E5 _____
6. Fodder	E6 _____
7. Vegetables	E7 _____
8. Fruit	E8 _____
9. All others	E9 _____
10. Total	E10 _____

F. Farmer Status

Code: 1. Full-time 2. Part-time

F _____

G. Percentage of family income from farm

Code: 1. 100% 2. 50-99% 3. 25-49% 4. less than 25%

G _____

H. Number of tractors owned and/or jointly owned

H _____

I. From where do you get your water supply?

Code: 1. canal only; 2. own tubewell (TW) only;
3. purchase TW water only; 4. canal plus own TW;
5. canal plus purchase TW; 6. own TW plus purchase TW;
7. canal plus own TW plus purchase TW; 8. Other (specify)

I _____

J. Do you get enough water for your crops each season?

Code: 1. 25% or less 2. 26-50% 3. 51-75% 4. 76-100%

J1 _____

J2 _____

VI. A. How did you first hear about PLL?

Code:
0. Not applicable/no response
1. From fellow villagers, friends, relatives,
etc., in this village
2. From someone outside this village (aside from
OFWM or Government agencies)
3. Was approached by an OFWM person
4. Happened to meet an OFWM person

A1 _____

A2 _____

A3 _____

- A. How did you first hear about PLL? (cont'd)
5. Saw the OFWM office sign and inquired within
 6. Witnessed PLL work in progress
 7. Radio, TV, other advertisement
 8. Approached OFWM office
 9. From other government person

VII. A. Have you ever tried to get PLL work done on your land?

1. Yes 2. No

A _____

B. If yes, why did not you succeed in getting it done?

1. Most important reason
2. Second most important
3. Third most important

B1 _____

B2 _____

B3 _____

Code:

0. Not applicable/no reply
1. Lack of approach to OFWM
2. Application to OFWM given, but no response received.
3. Unable to locate and meet with OFWM
4. Was ruled ineligible for OFWM program (land too rough to PLL)
5. OFWM ignored me because I am a small farmer and not politically influential
6. Laziness
7. OFWM is going to start PLL work on my land in the very near future.

C. If no, why haven't you tried to get PLL work done on your land?

(Why have you not availed yourself of PLL?)

1. Most important reason
2. Second most important reason
3. Third most important
4. Fourth most important
5. Fifth most important

C1 _____

C2 _____

C3 _____

C4 _____

C5 _____

Code:

0. Not applicable/no reply
1. Fields already level enough; not convinced of its benefits; lack of knowledge; only recently came to know about PLL program; simply not interested (with no particular reason); land can be leveled by self to satisfaction; laziness; too busy for PLL.
2. Land double-cropped (no available land); loss of cropping season
3. Tractor and/or implement rental too costly/ not available
4. Lack of approach to OFWM
5. Rate of subsidy too low
6. Subsidy too difficult to get from OFWM
7. Subsidy check too difficult to get cashed from bank
8. Mistrust of OFWM; reputation of OFWM workers for doing it properly, on time, and when requested is not good.
9. Other (specify) _____

VIII. A. If you ever want to get PLL for your land, from which source would you prefer? A _____

Code:

1. Self 2. Private source 3. OFWM
 4. Self and private 5. Self and OFWM
 6. Private and OFWM 7. Self and private and OFWM

IX. Credit availability and arrangements for PLL.

A _____
 B _____
 C _____

X. Suggestions

A _____
 B _____
 C _____
 D _____
 E _____