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(ATIP)

PROGRESS REPORT

1987-88 TECHNOLOGY OPTIONS TESTING WITH FARMER GROUPS
(RESEARCH-ORIENTED, FMFI TRIALS)

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PREFACE

ATIP Progress Reports are prepared and circulated to make ATIP research findings easily available to GOB personnel and researchers interested in Botswana farming systems. These reports are not subject to professional review outside the Francistown team. Therefore, data and findings presented in the Progress Report series may be subject to further revision and should not be cited without permission of the authors. Findings in this report do not necessarily reflect the official views of ATIP, DAR or USAID.

This Progress Report presents information on the 1987-88 Research-Oriented Technology Options Testing Farmer Group activities. Information is presented on the FMFI trials implemented by group members. The results of the End-Of-Seasons Survey conducted of the group members are also presented.

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1987-88 TECHNOLOGY OPTIONS TESTING WITH FARMER GROUPS (TOTFG) (RESEARCH-ORIENTED, FMFI TESTING)

1. ABSTRACT

During the 1987-88 cropping season, 143 farmers participated in the research-oriented technology options testing with farmer groups programme. Participants signed up to conduct 227 separate trials, of which 152 were successfully implemented. Seven different technologies were tested. Most farmers participated in monthly group meetings to discuss their trial experiences. An End-of-Season Survey was administered to 119 of the farmers who had successfully implemented at least one trial. Field days were held in each village to allow farmers to view and discuss the results of the trials.

Regarding technology performances, double ploughing and P-fertilizer applications gave the largest yield increases (60 and 50 percent respectively, across crops and locations). Some of the other technology options tested also provided yield increases, but of a much smaller magnitude. The indeterminate cowpea variety 8005C out yielded the determinate types (TVX, ER7 and Blackeye) in most cases, and was consistently ranked as first or second preference by farmers.

The technologies most commonly selected for testing by farmers were double ploughing, groundnut seed treatment and cowpea variety trials. Double ploughing was probably most commonly selected because it required no new equipment or skills for implementation, and was thought to be effective. The selection of the groundnut and cowpea trials probably reflected farmers' strong interest in these high-value crops.

2. OBJECTIVES

This was a continuation of the FMFI testing by research-oriented, Technology Options Testing Farmer Groups conducted in 1985-86 and 1986-87. The objectives of the groups were:

(a). To test a broad range of innovations under farmer managed conditions for increased productivity and grain yield dependability.
(b). To involve farmers and agricultural demonstrators (ADs) directly in the farming systems development process.
(c). To determine what types of innovations were most appealing to different types of farmers.

3. JUSTIFICATION

Numerous technological innovations have been developed in Botswana (and elsewhere) which may be relevant to subsistence farmers in the Tutume Agricultural District. However, it is often difficult (due to time constraints) to evaluate a wide range of these innovations under researcher managed conditions in on-farm tests. Furthermore, it is sometimes a problem to assess which innovations might be most relevant to specific farmers. It was therefore decided to present a wide range of technological cropping options (particularly those relating to specific contingencies at different times of year) to a group of

farmers. Farmers were asked to select innovations that seemed most relevant to their situation, and to test those with some researcher guidance (and provision of inputs). Monthly meetings were held with the groups to discuss problems and progress. Through personal selection the farmers demonstrated which types of innovations seemed most appropriate to them, and the researchers were able to observe the effectiveness of the innovations and to work with the farmers towards developing improved crop production systems. By including AD's in the group monthly meetings, the AD's also became part of the technology development process.

4. APPROACH

In September, a kgotla meeting was held with participating ATIP farmers, members of Village Farmers' Committees and the local ADs in the three villages where ATIP had been working. At this meeting ATIP staff presented:

(a). The results from the previous year's research.

(b). An invitation to all interested farmers, to attend a special meeting where technical options were to be reviewed (these included both new technologies and currently recommended ones).

At this meeting, a wide range of technology options was discussed (see list, Table 1). Farmers were then asked to select any innovation or package of innovations they wished to test in the coming year. Those farmers electing to perform a test (or tests) then formed the farmer groups that met monthly. The ADs were also invited to attend these meetings, where progress and problems were discussed.

The types of innovations introduced included:

(a). Tillage/water conservation techniques
(b). Planting method options
(c). Crop varieties, combinations, and rotations
(d). Manure and fertilizer possibilities

Depending on the degree of interest, some or all of the farmers wishing to test a specific innovation were supplied with the necessary inputs and machinery by ATIP. Trials were laid out side by side with a traditional control. Plot sizes were 10 meters by 50 meters. Seeding rates were kept constant across plots within a field, and were generally applied as 4 kilograms per hectare for sorghum, 2 kilograms per hectare for millet and 20 kilograms per hectare for large seeded crops (cowpeas and maize). A record was kept by ATIP staff regarding the dates of all operations, equipment used, and grain yield. Baseline Surveys for new members and End-of-Season Farmer Assessment Surveys for all members were administered. More detailed descriptions of trials implementation procedures can be found in PR F87-6.[1]

Field days were held in each of the villages. At these field days, selected participating farmers had the chance to show their trials to the rest of the group, as well as to farmers from outside the group and to regional extension staff. They described the trial, their observations and opinions, and answered questions from the group of visitors.

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[1]. F. Worman, G. Heinrich, S. Masikara, B. Mabongo, and S. Bock. "1986 Farmer's Groups Technology Options Testing Trial". ATIP. October 1987.

TABLE 1: ESSENTIAL TECHNOLOGY DECISION OPTIONS, TUTUC, FRANCISTOWN AREA, 1987-88

TECHNOLOGY	USES	CONDITIONS FOR APPLICATIONS (AND TIMING)	RESOURCES AND INPUTS REQUIRED (LABOUR, CASH)
SUBJECT: WATER CONSERVATION			
A) Double ploughing	Reduce run-off & erosion, conserve water.	Preliminary tillage to be done a) on very early season rains(S/O) b) on dryer periods between rains NB: Not to be done after mid-Jan.	Non-restricted access to draught power. Will increase ploughing labour and draught use where animal draught only is used.
B) Contour ploughing	Reduce run-off & erosion. Conserve water.	Field contours should be marked before onset of rains.	Nothing extra, contouring done free by SCS (CDB).
C) Contour hand ploughing	Concentrate water. Reduce run-off & erosion, increase soil porosity.	Field contours marked before onset of rains.	Extra weeding between strips.
D) Fallow	Conserve water between years.	Field not planted, weed control required.	Chemical or mechanical weed control.
SUBJECT: CROP VARIETIES			
A) Long season crops & varieties	Traditional system uses rains over season.	Seed saved from prior year. Plant from Oct - Feb.	Harvesting usually after weeding completed.
B) Short season crops & varieties: Cowpeas K87 (60-70 day) Millet Serere 64 (75-80) Sorghum 33 (85-90) Sorghum 630 (70-80)	Reduce risk of total crop failure due to early termination of rain.	Suggested sites through season: 1) Before Dec 1 - 75% LS, 25% SS 2) Dec 1 - Jan 15 - 50% LS, 50% SS 3) Jan 15 onwards - 25% LS, 75% SS.	Labour available for harvesting, drying from early March onwards. Purchase seed? Bird scaring may be necessary earlier than usual.
C) Annual forage crops	Provide supplemental dry season feed of good quality for livestock.	Livestock needs (e.g., early feeding of draught animals, fattening for sale, milk production).	Planting labour in Feb., weeding in March. Seeds (free from ALDEP). Harvesting May-June.
SUBJECT: PLANTING METHODS			
A) Broadcast (traditional)	Buffered planting system for non-optimal soil moisture condition.	Anytime especially for farmers without planting equipment or planting on non-optimal soil water.	None extra (plough, animals, labour).
B) Broadcast (Cyclone Seeder)	Same as above. More even seed dist. Decrease within field plant stand variation.	Farmer interest.	Cyclone seeder, no extra labour.
C) Hand row planter	Plough on poor soil water, plant on good moisture (for farmers without draught - ensures good plant stand).	Anytime, best on good moisture, or completely dry soils. Good soil preparation required.	Well tilled seedbed. Sanitan hand row planter or Hunter planter. Extra labour at planting. (Hunter Planter to be emphasized).

TABLE 1: ESSENTIAL TECHNOLOGY DECISION OPTIONS, TUTUC, FRANCISTOWN AREA, 1987-88 (CONTINUED)

TECHNOLOGY	USES	CONDITIONS FOR APPLICATIONS (AND TIMING)	RESOURCES AND INPUTS REQUIRED (LABOUR, CASH)
D) Sebele row planter	Ensure good plant stand.	Requires good soil water condition for effective use. Also requires understanding of mechanics. Use anytime before Jan 15 (plough/plant same time there after). Well trained draught power.	Sebele row planter. Planting labour. Well trained draught power.
E) Improved harnesses, yokes, and animal care. Proper plough adjustment.	Improve efficiency of ploughing operations, improved animal well-being.	Throughout ploughing operations.	Improved equipment. Knowledge of animal husbandry (rudimentary). Cost of equipment.
SUBJECT: WEEDING			
A) Hand weeding	Traditional.	Use on broadcast fields.	Family or hired labour.
B) Inter-row weeder (modified Indian design)	Reduce weeding time, increase timeliness of weeding.	Row planting situation.	Donkeys, weeder N.B. Depending on availability from Sebele.
SUBJECT: FORAGES			
A) Annual forages Bahala millet and Lablab	Provide supplemental dry season feed of good quality for early feeding of draught animals,	Anytime, but only on good moisture or completely dry soils. Good soil preparation required.	Well tilled seedbed. Broadcast and plough down or use Sebele row planter. March seeding? May-June harvesting. Storage facilities.
B) Perennial forages Buffel grass and Siratro	Stall feeding, supplemental feeding selected livestock.	Land available for permanent pasture. Seed before Feb.15. Good soil preparation required.	Broadcast on well tilled seedbed, cover with brush harrow. Seeds (free from ALDEP). Draught power, weeding labour (late season), harvest labour. Storage facilities.
SUBJECT: STALL FEEDING			
A) Fattening market animals for sale in Oct.-Dec.	Marketing crop residues through livestock.	Animals available for feeding. Feed for approx. 100 days from July-Aug. to Oct.-Dec. Access to good market.	Stall for feeding built with local materials. Purchased maize bran, salt and bonemeal. Use spare labour during dry season.
SUBJECT: MANURE/CHEMICALS			
A) Animal manure spread on fields	Increase soil fertility and moisture holding capacity.	Use on all soils in TAD.	Donkey cart, considerable labour for transport to fields and increased weeding.
B) Chemical fertilizer	Increase soil fertility.	Use P on all soils, use N on poor soils under higher rainfall conditions.	Transport for fertilizer to field, labour for broadcasting, and cash to purchase fertilizer.
C) Captan	Seed treatment for groundnuts. Protect expensive seed. Improve germination percentage.	Availability of Captan and C. nut seed. Farmer must understand basics of toxic chemical use.	Cost of Captan.

TABLE 1: INITIAL TECHNOLOGY DECISION OPTIONS, TOTFG, FRANCISTOWN AREA, 1987-88 (CONTINUED)

TECHNOLOGY	CASE	CONDITIONS FOR APPLICATION (AND TIMING)	RESOURCES AND INPUTS REQUIRED (LABOUR, CASH)
SUBJECT: CROP VARIETY TESTING			
1) Advanced selection of genotypes.	Farmer evaluation of potentially improved sorghum & cowpea genotypes.	Availability of seed.	None extra.

a. LS = Long Season, SS = Short Season, TAD = Tutume Agricultural District

Some of the changes that were made this year included the following:

(a). Farmer comparisons were slightly more controlled. For example, a farmer who wished to test double ploughing (DP) with fertilizer versus DP/row planted (as happened last year) was encouraged to separate his trials into DP with and without fertilizer, DP with and without row planting, and to include traditional checks in each.

(b). Where farmer feed back on a new technology was required, or where requests were made by other researchers for tests on items like variety trials, and if insufficient farmers elected to test the technology, ATIP actively sought farmers in the group to take on these tests in addition to the tests they selected themselves.

5. RESULTS

5.1 AGRONOMIC RESULTS

5.1.1 Overview

The number of volunteer farmer participants this year increased to 40 in Marapong, 46 in Mathangwane and 57 in Matobo. These participants signed up to conduct 221 separate trials. Of these, 69 were either not implemented, or failed to produce any yield. One hundred and fifty-two trials were successfully completed. That is, they were correctly implemented, properly harvested and produced some grain yield. These trials produced a significant amount of useful data and are discussed by trial-type below. The type and number of trials successfully implemented are listed by village in Table 2.

In addition, three farmers experimented with a two-furrow plough, and three tractor owners tried an improved version of the tractor mounted plough/planter.

Dates of group meetings are listed in Table 3.

After the first meeting to introduce technology options for selection, no further meetings were held in November because there had been no rain, and therefore it was assumed no one had ploughed or planted and there would be little to discuss. The rains began in late November. No meetings were held in December because the rain had been continuous, allowing little time for planting. Furthermore, most farmers were still busy organizing their draught sources. Again, little progress had been made in planting trials and it was assumed there was little to discuss. In retrospect, deleting those meetings was a serious mistake. Both November and December should have been used to further discuss trials procedures, for

distribution of inputs and discussions on farmers' difficulties in arranging draught power. Information was lost, and between October and planting time (Dec/Jan), a number of farmers forgot their implementation procedures, resulting in an increased number of invalid trials. Also, group momentum was lost. Clearly it was important to maintain regular meetings of the research group, regardless of whether or not farm operations were going on.

TABLE 2: NUMBER AND TYPES OF TRIALS SUCCESSFULLY IMPLEMENTED BY VILLAGE, TOTFG TRIALS, FRANCISTOWN AREA, 1987-88

TYPE OF TRIAL	NUMBER SUCCESSFULLY IMPLEMENTED			TOTAL SUCCESSFUL	TOTAL FAILED	TOTAL TRIALS
	MATOBO	MARAPONG	MATHANGWANE			
DOUBLE PLOUGHING	49	9	4	62	31	93
GROUNDNUT SEED TRMT.	11	19	14	44	16	60
COWPEA VARIETY TRIAL	5	13	3	21	13	34
R/P VERSUS B/CASTING	0	1	9	10	0	10
FERT. (20KG P/HA)	1	2	5	8	0	8
LONG & SHORT SEASON CROP MIX	4	3	0	7	9	16
TOTAL	70	47	35	152	69	221

TABLE 3: DATES OF FARMER GROUP MEETINGS, TOTFG, FRANCISTOWN AREA, 1987-88

VILLAGE	MEETINGS DATES						
MATOBO	16/10/87	05/2/88	18/3/88	16/4/88	*24/6/88		
MARAPONG	21/10/87	20/1/88	24/2/88	02/3/88	26/3/88	*29/6/88	
MATHANGWANE	28/10/87	22/1/88	19/2/88	19/3/88	*17/6/88	13/7/88	15/8/88

*. Field days were held on these dates instead of the normal group discussion meetings.

Attendance rates at meetings differed across villages. At Matobo, attendance was usually about 30 to 40 out of 57 participants, or about 60 percent. At the other two villages it was usually lower, with discussion groups averaging between 10 and 20 persons per meeting. This was unfortunate because it meant that not all farmers were participating equally in the technology development and assessment process. But conversely, had all the members turned up, it would have been more difficult to discuss issues within the larger groups. In any case, all farmers who conducted successful trials were interviewed in an End-of-Season Survey, so their observations on the technologies tested were recorded. Common problems observed by farmers and raised in discussion during the year included the following:

(a). It was often difficult to implement trials when depending on hired tractors for draught power. This was because the tractor drivers were in a hurry (due to great demand) and did not want to perform small plot work, or they would not return to the field to complete ploughing on a double-ploughed plot. In addition, farmers could never tell exactly when the tractor would

arrive to plough. Consequently farmers were sometimes absent when their fields were ploughed and could not supervise trial implementation.

(b). The original (imported) Master planters worked well, especially on large seedad crops. The new ones made by the RIIC in Kanye did not work as well and were in need of modification. Some farmers thought they were all heavy and difficult to pull, others thought they were fine.

(c). The people who tried the two-furrow plough said it worked well and was quite efficient, once the operator learned to set it correctly. One lady had difficulty in that it ploughed "too deep", causing problems with emergence of the broadcast seed.

(d). Cowpea pests became a problem in March, and later caused a great yield reduction in some fields (despite the availability of sprayers at the ATIP compounds).

(e). Waterlogging caused yield reductions and occasional total losses on some plots.

During March/April, field days were held in lieu of the regular monthly meetings. These were planned largely by ATIP researchers, but with input from both farmers and the regional DAFS staff. Attendance ranged from 70 to 120 people on field tours (including farmers from all three villages, plus a fourth, Mapoka in North East District). District and regional DAFS staff were well represented, and several scientists from Mahalapye and Sebele also attended. At each stop, the owner of the field presented the trial to the group, described their observations on the technology, and responded to questions from visitors. Discussion among farmers was lively. These field days were extremely effective in bringing farmers, extensionists and researchers together in the field to discuss technologies and problems.

5.1.2 Trials Results

Only trials that produced a measurable grain yield in at least one plot were included in the analyses. The effects of "improved" technologies on grain yields were analyzed across locations using paired "t-tests". Trials that were not implemented, were improperly implemented, or failed to produce any grain in any plot were excluded from the analyses. Failed trials are listed by treatment, village and reasons for failure, under the appropriate sections.

Analysis of the data is not as detailed as might be possible because the objective of the trials was simply to obtain a general estimate of the effectiveness of the various technologies under farmer managed conditions, and especially to quantify farmers' perceptions of a technology, what niche it filled and how technologies might be made more easily adoptable. Hence, while the trials data are useful and important, the results of the End-of-Season Survey may be even more so.

5.1.2.1 Double Ploughing (DP)

The yield data for individual comparisons (trials that produced some grain in at least one plot) are given in Appendix A1, along with the village, farmer number, traction source, dates of planting, details on crops used and whether the crop was row planted. Summary yield data are given in Table 4.

In Table 4, the sorghum data were all from variety Segaolane, except for one trial which used variety 650. DP out yielded single ploughing (SP) in all but two cases where yields were equal (see Appendix A1). The millet trials were all performed with variety Serere 6A, and DP out yielded TC in 100 percent of the cases (see Appendix A1). Over all cereals, DP out yielded SP by 69 percent (488 kilograms per hectare vs. 288 kilograms per hectare) and DP yields were greater than SP yields in 94 percent of all cases.

Cowpea yields were low this year, largely due to the combined effects of too much water (waterlogged soils) and heavy insect infestations (largely pod-sucking insects) in March/April. Cowpea trials involved 19-Blackeye, 8-ER7, 2-B005C and 1-TVX comparison (see Appendix A1). Yields of early maturing varieties (e.g., ER7) were in some cases hurt by molding, caused by continuous rainfall during grain-ripening. In any case, DP significantly out yielded SP by 39 percent, and yields from DP plots exceeded yields from SP plots in 83 percent of the comparisons.

TABLE 4: SUMMARY OF GRAIN YIELD DATA FROM DP TRIALS, OVER ALL LOCATIONS, TOTFG TRIALS, FRANCISTOWN AREA, 1987-88

CROP	MEAN YIELDS (kg/ha) SINGLE PLOUGHED	DOUBLE PLOUGHED [a]	% INCREASE IN YIELDS	NO OF OBSERVATIONS
ALL CROPS	212	339 ***	60	82 [b]
SORGHUM	319	569 *	78	13
MILLET	254	427 **	68	18
COWPEAS	130	181 ***	39	30

a. *, **, ***, denote significant differences between treatments at the levels of 5, 1 and 0.1 percent probability, respectively.

b. The sum of the number of observations of sorghum, millet and cowpeas does not equal this number of observations of all crops because one trial was with maize.

Over all crops and locations, DP gave an average increase in grain yield of 60 percent, and yields from DP exceeded those of SP in 89 percent of the trials. This yield increase was slightly lower than had been observed from FMFI trials in previous years (about 70 percent). This was probably due to the higher percentage of cowpea comparisons in this year's set of trials, and the fact that it was a poor year for cowpeas generally. The percent yield increase observed in the cereals was the same as in previous years, despite the above normal rainfall. This is an important observation, since it has sometimes been argued that DP would not be useful in wet years. Regarding DP trials that produced no measurable quantity of grain from either plot, these are summarized by village and reason for failure in Table 5.

5.1.2.2 Groundnut Seed Treatment Trials

In these trials, farmers planted treated and untreated groundnut seed (variety Sele) on side-by-side plots of 10 meters by 25 meters each. The treated seeds received a treatment of Captan. Tillage and planting methods were at the farmers discretion, but were the same for both plots. Both plots were planted on the same day, often by hand into ploughed soil. Individual trials data (village, farmer number, traction source, planting date, tillage method and row planting data) are given in Appendix A2 for trials that produced measurable grain yields.

TABLE 5: FAILED DOUBLE PLOUGHING COMPARISONS, BY VILLAGE AND REASON FOR FAILURE, TOTFG TRIALS, FRANCISTOWN AREA, 1987-88

REASON FOR FAILURE	MATOBO PLANTED	MATOBO NOT PLANTED	MARAPONG PLANTED	MARAPONG NOT PLANTED	MATHANGWANE PLANTED	MATHANGWANE NOT PLANTED	TOTAL
LACK DRAUGHT POWER	0	3	0	3	0	0	6
WATERLOGGED SOILS	0	0	0	0	0	0	0
BIRD/INSECT DAMAGE	0	0	0	0	0	0	0
MISIMPLEMENTATION [a]	4	0	1	0	1	0	5
LATE PLANTING [b]	10	0	0	0	0	0	10
OTHER [c]	4	0	1	4	0	0	9

a. Misimplementation of trial (i.e., not a statistically valid comparison).
b. Planted too late to mature before cold weather set in.
c. Miscellaneous (included: farmer took off-farm employment before planting, farmer absent when field was ploughed, no emergence due to lack of rain in January, tractor breakdowns, and unknown).

In summary of that data, there were 44 paired comparisons that gave some seed yield. Mean seed yields (unshelled) were 342 kilograms per hectare for treated seed, and 276 kilograms per hectare for untreated seed. This difference was significant at the 1 percent level of probability. Yield increase was approximately 24 percent from treated seed. The benefit from seed treatment was probably less this year than might be expected in dryer years because germination and emergence conditions were generally excellent. Soil stayed moist longer because of the heavy rains, and cloud cover generally reduced soil capping. In less ideal conditions emergence would likely be slower, exposing the seedlings to the danger of fungal attack for longer. Hence the protection by fungicide could be expected to produce a greater difference in stand densities and seedling vigor. Nonetheless, the seed treatment proved beneficial to yield even in this rainy year.

It should be noted that this trial was very popular with farmers, and was generally planted earlier than other trials. Furthermore, with very few exceptions, it was the only trial in which farmers showed any willingness to plant the seed by hand, after ploughing. In some cases, farmers who had difficulty arranging draught power went so far as to till the plots with a hand hoe and plant the seeds. The priority that farmers placed on obtaining the groundnut seed and getting the trials planted exceeded that observed for any other type of trial, and indicated an intense interest among farmers in groundnut production that was previously unrecognized. Sixteen groundnut seed treatment trials failed to produce any seed from either plot. The reasons for failure are summarized in Table 6.

5.1.2.3 Row Planting Versus Broadcast Planting Trials

These trials were planted as paired comparisons on side-by-side plots, each 10 meters by 50 meters in size. All ten of these trials produced measurable grain yield. The row planting was done using one of four different types of equipment (including a hand hoe in one case). Details of equipment, planting dates by plot, traction source, crop and grain yields are given in Appendix A3.

TABLE 6: FAILED GROUNDNUT SEED TREATMENT TRIALS, BY VILLAGE AND REASON FOR FAILURE, TOTFG TRIALS, FRANCISTOWN AREA, 1987-88

REASON FOR FAILURE	MATOBO PLANTED	MATOBO NOT PLANTED	MARAPONG PLANTED	MARAPONG NOT PLANTED	MATHANGWANE PLANTED	MATHANGWANE NOT PLANTED	TOTAL
LACK DRAUGHT POWER	0	0	0	4	0	0	4
WATERLOGGED SOILS	0	0	2	0	0	0	2
BIRD/INSECT DAMAGE	0	0	0	0	0	0	0
MISIMPLEMENTATION [a]	0	0	0	0	2	0	2
LATE PLANTING [b]	2	0	0	0	0	0	2
OTHER [c]	1	0	0	5	0	0	6

a. Misimplementation of trial (i.e., not a statistically valid comparison).
b. Planted too late to mature before cold weather set in.
c. Miscellaneous (included: farmer took off-farm employment before planting, farmer absent when field was ploughed, no emergence due to lack of rain in January, tractor breakdowns, and unknown).

Within this group of trials, planting of the paired plots was done on the same day in five locations, while in the other locations, the row planting was typically done sometime after the traditional check plot was planted. The purpose was to see whether non-draught power owners could increase grain yields by separating the ploughing and planting operations.

People who do not own their own draught power cannot always be sure of obtaining a draught source at the optimal planting time. The hypothesis was that by separating the operations farmers could plough when draught power was available, and then plant when conditions were optimal (preferably using a human-powered machine).

When planting was performed on both co[illegible]on plots on the same day, row planted plots yielded an average of 117 kilo[illegible] per hectare versus 99 kilograms per hectare for BC planted plots (see Appe[illegible]ix A3). This slight increase in yield was consistent, but not significant at the five percent level of probability.

When the two operations were separated, row planted plots gave mean yields of 230 versus 162 kilograms per hectare for broadcast planted plots. This difference was not consistent across comparisons, and again was not significant. Furthermore, this sub-set of trials contained one pair of observations where the broadcast plot was actually planted three days later than the row planted plot (using a hoe to cover the seed). This occurred because the farmer did not clearly understand the trial proce[illegible]re. It was not really a valid comparison of the systems. When this trial was excluded from the analysis, the mean yields of RP versus BC in this subset of trials changed to 210 versus 192 kilograms per hectare.

In a comparison using all ten trials, mean yields of RP versus BC were 173 versus 131 kilograms per hectare, respectively, again not significant at the five percent level. This group of trials was small (10 comparisons only), and the sub-sets were smaller yet. A fairer assessment of the benefits of row planting will be obtained when a sufficiently large body of data are collected over years. However, these data do serve to highlight the fact that, like any other technological innovation in Botswana, row planting does not increase yields 100 percent of the time, and it is an activity which requires some skill and timing to be used effectively by farmers.

5.1.2.4 Cowpea Variety Trials

These trials were conducted in all three villages and proved quite popular. There was no shortage of farmers interested in performing the comparison. Whether this was because they were genuinely interested in the comparison or because they were just after cowpea seed was difficult to discern. Most likely it was a combination of both motives.

In this trial, farmers planted four cowpea varieties (Blackeye, ER7, TVX and B005C). All varieties were planted on the same day, using the same tillage/planting system. The tillage/planting system was left to the farmer's discretion, but was to be implemented the same way for all varieties. Of the 21 trials planted, eight were planted in the traditional manner, four were double ploughed, four were row planted, and five trials were double ploughed and row planted. Thirty-four farmers opted for the trial. Across the three villages, thirteen of these were implemented properly with all four varieties and produced measurable grain yield. Eight more in Marapong were properly implemented, but for two varieties only. These also produced some grain yield. Complete data on all trials that yielded are given in Appendix A4. Summary data for yields and farmer ratings are presented in Table 7. Thirteen trials were discarded from the analysis either because they were never planted, were improperly implemented or failed to produce any grain yield (see Table 8).

TABLE 7: MEAN YIELDS AND FARMER RATINGS FOR FOUR COWPEA VARIETIES, TOTFG, TRIALS, FRANCISTOWN AREA, 1987-88

	MEAN YIELD KG/HA				NO.	FARMER RATING [a]			
	BLACKEYE	TVX	ER7	B005C	OBS.	BLACKEYE	TVX	ER7	B005C
VILLAGE									
MATOBO	101	87	99	168	5	1	4	3	2
MATHANGWANE	61	224	124	168	3	3	1	2	2
MARAPONG	308	324	205	582	5	2	3	4	1
ALL VILLAGE	171	210	145	318	13	2	3	4	1
COMPARISON PAIRS (MARAPONG)									
B/EYE VS ER7	187	-	130	-	5	1	-	2	-
B/EYE VS TVX	50	126	-	-	1	2	1	-	-
B/EYE VS B005C	0	-	-	138	1	2	-	-	1
ER7 VS B005C	-	-	234	400	1	-	-	2	1

a. Ratings: 1 = best to 4 = worst.

TABLE 8: FAILED COWPEA VARIETY TRIALS, BY VILLAGE AND REASON FOR FAILURE, TOTFG TRIALS, FRANCISTOWN AREA, 1987-88

REASON FOR FAILURE	MATOBO		MARAPONG		MATHANGWANE		TOTAL
	PLANTED	NOT PLANTED	PLANTED	NOT PLANTED	PLANTED	NOT PLANTED	
LACK DRAUGHT POWER	0	0	0	3	1	1	5
WATERLOGGED SOILS	1	0	1	0	0	0	2
BIRD/INSECT DAMAGE	0	0	0	0	0	0	0
MISIMPLEMENTATION [a]	0	0	0	0	0	0	0
LATE PLANTING [b]	1	2	0	3	0	0	6
OTHER [c]	0	0	0	0	0	0	0

a Misimplementation of trial (i.e., not a statistically valid comparison).
b. Planted too late to mature before cold weather set in.
c. Miscellaneous (included: farmer took off-farm employment before planting, farmer absent when field was ploughed, no emergence due to lack of rain in January, tractor breakdowns, and unknown).

In the three trials that compared all four varieties in Mathangwane, TVX consistently out yielded all other varieties. At the other two locations, and in most other trials, B005C was the top yielder. This was because B005C ripened very late in the season. By that time the rain had stopped and the most severe insect attacks had passed. Thus the grain yield of B005C was relatively less affected by the mould and insect pests (mostly pod-sucking insects) that severely damaged the grain yields of the other, earlier maturing varieties. There were no serious virus infections on any of the four varieties.

In terms of popularity among farmers, B005C was consistently the first or second choice. This was because of its prolific leaf production (for green vegetable) and generally higher seed yields. (Note: B005C could easily fail to produce seed in seasons where the rainfall was less or where it stopped earlier, because of its long growing season). Blackeye was the next most popular. The yields of Blackeye and TVX were generally similar (except in Mathangwane), but Blackeye was preferred because of the leaf quality. TVX was third in the overall ranking, but the difference in ranking with ER7 was not great. Because of the heavy rainfall this year all three shorter-season varieties performed poorly (due to insect damage and mould). However, all of them also showed excellent yield potential. Of the three, Blackeye was generally preferred for leaf production and quality. TVX received some preference over ER7, because of its somewhat higher yields, and ER7 was of lowest preference because of low leaf production, and because early maturation was not a benefit in this year of heavy rainfall. It is the authors' opinion that these rankings could easily change in seasons with different rainfall patterns.

In summary, the trials were popular with farmers. Of the two new varieties, B005C out yielded the two standard checks, when all four varieties were compared across locations (based on observation, not from statistical analysis). Farmers ranked B005C as the most preferred variety, and also favoured TVX over ER7. However, Blackeye was still preferred over TVX, probably for leaf quality.

Researchers observations were that: (a) both TVX and B005C showed good yield potential on-farm; (b) the relative performance of the genotypes might change in seasons of different rainfall patterns; and (c) therefore another year of testing would be a good idea. (However, there was nothing to indicate that these two new varieties should not be released). Having all four varieties available to farmers as optional choices would probably be a good idea.

5.1.2.5 Fertilizer Trials

Eight fertilizer trials were selected this season. All were properly implemented, and all produced a grain yield. Full data regarding villages, farmers, traction source, planting dates crops and plot yields are given in Appendix A5. Tillage methods and crop selection were at farmers discretion. All trials were single ploughed/broadcast planted. Comparisons were on side-by-side plots, each 10 meters by 50 meters in size. The fertilized plot received 200 kilograms per hectare of single super phosphate. Four of the trials were performed using sorghum (variety Segaolane), two used cowpeas (variety Blackeye), one used millet (variety Serere 6A), and one used maize (variety Kalahari Early Pearl).

In all cases, the plot receiving fertilizer produced more grain that the plot which did not. Cowpea yields were generally lower than cereal yields, but over all crops and villages, mean grain yields from plots receiving fertilizer versus those which did not, were 550 kilograms per hectare and 366 kilograms per hectare, respectively. This was significant at the five percent level of

probability. Thus adding the single super phosphate gave a mean yield increase of about 50 percent. The constancy and magnitude of the yield benefit reflects what could be expected from small fertilizer applications in years of "good" rainfall.

5.1.2.6 Long and Short Season Crop Mix

These trials were part of an on-going study of the potential to increase the reliability of crop yields through planting a mix of long, medium and short season crops throughout the year. Sixteen of these trials were selected for testing. Nine of those were discarded from the analysis, largely because they were never planted due to draught power limitations or because they were improperly implemented (see Table 9). Of the remaining seven, all included Segaolane (medium) and 65D (short maturity) sorghum. Four also included Town, a long season sorghum.

Within a location, the varieties were planted on plots of 10 meters by 50 meters each. The tillage/planting method was at the farmer's discretion and varied between locations, but was held constant across crops within a trial location. All locations were planted between December 20 and January 21. Full details on village, farmer number, planting dates, tillage systems, crops and crop grain yields are presented in Appendix A6.

This year, rainfall was above normal, and continued into April. Across locations, Segaolane consistently out yielded both 65D and Town. Mean yields of Segaolane versus 65D were 249 versus 155 kilograms per hectare, respectively. This was significant at the five percent level. At the four locations where all three were compared, Segaolane consistently out yielded Town. Town and 65D varied in their dominance, giving approximately the same mean yields across the four locations (207 versus 214 kilograms per hectare, respectively).

This was too small a sample to generate statements about yield stability. The data will need to be combined with more observations collected in the future. In general, Segaolane proved itself an excellent variety this year, and even the long season variety Town performed reasonably well in this relatively favourable season. The benefits of the short season variety 65D would likely be more pronounced in seasons where there was an early cessation of the rains.

TABLE 9: FAILED LONG AND SHORT SEASON CROP MIX TRIALS, BY VILLAGE AND REASON FOR FAILURE, TOTFG TRIALS, FRANCISTOWN AREA, 1987-88

REASON FOR FAILURE	MATUBO		MARAPONG		MATHANGWANE		TOTAL
	PLANTED	NOT PLANTED	PLANTED	NOT PLANTED	PLANTED	NOT PLANTED	
LACK DRAUGHT POWER	0	0	0	4	0	0	4
WATERLOGGED SOILS	0	0	1	0	0	0	1
BIRDS/INSECT DAMAGE	0	0	0	0	0	0	0
MISIMPLEMENTATION [a]	0	0	0	0	1	0	1
LATE PLANTING [b]	0	0	0	0	0	0	0
OTHER [c]	0	0	1	0	0	0	1

a. Misimplementation of trial (i.e., not a statistically valid comparison).
b. Planted too late to mature before cold weather set in.
c. Miscellaneous (included: farmer took off-farm employment before planting, farmer absent when field was ploughed, no emergence due to lack of rain in January, tractor breakdowns, and unknown).

5.1.3 Trials Summary

Of the major technologies selected for testing by the farmers, double ploughing was the most commonly chosen (Table 2). However, both the groundnut seed treatment trial and the cowpea variety trial were also very popular (in part because these are high value crops and farmers were anxious for the seed).

In terms of performance, DP also gave the greatest yield increase (69 percent for cereals, 60 percent over all crops). This was followed by phosphate fertilizer which gave an average 50 percent yield boost, and groundnut seed treatment which gave a significant 24 percent yield increase. Row planting tended to increase yields over broadcasting, but the difference was not significant at the 5 percent level of probability. Regarding the cowpea variety trial, B005C out yielded the other three varieties in most cases, and was always first or second in terms of farmer ratings. The dominance of B005C reflected its capacity for leaf production, good leaf quality, and the fact that it matured in the relatively dry, insect free period at the end of the season.

Of major interest this year was the observed willingness on the part of farmers to invest extra time and effort in the cultivation of high value crops (cowpeas and groundnuts). Numerous farmers planted their groundnut trials by hand, using a hoe, to ensure a reasonably early start. They do not commonly do this with other crops. In the 21 valid cowpea variety comparisons, more than half of the farmers (13 out of 21) either double ploughed all plots, row planted all plots, or did both, even though the tillage/planting method was left to their own discretion. This implies that they see value in both of these operations, and are willing to use them on crops that they value, even if they do not have the time or resources to implement them on the entire field.

Lastly, of the 221 trials that were initially requested, 69 were unsuccessful (31 percent). That is, they were not implemented, improperly implemented or failed to produce any yield. The major reasons for trial failure are presented below in Table 10.

TABLE 10: FAILED TRIALS, TOTFG TRIALS, ATIP, FRANCISTOWN 1987-88

REASON FOR FAILURE	NO. OF TRIALS	PERCENT
1. DRAUGHT POWER LIMITATIONS [a]	19	28
2. WATERLOGGING	5	7
3. BIRDS AND INSECT PESTS	0	0
4. IMPROPER IMPLEMENTATION (INVALID COMPARISON)	10	14
5. PLANTED TOO LATE TO MATURE BEFORE COLD WEATHER	13	19
6. MISCELLANEOUS [b]	22	32
TOTAL	69	100

a. unable to obtain draught power at all, unable to get it at the required or appointed time, had to share it, or could not get it to return and finish the trial (e.g., with double ploughing).
b. Farmer was not available when the tractor came to plough; got a job and abandoned the trial; trial failed to germinate in January drought; planting equipment not available when required; unknown.

As can be seen, the reasons for failure were more commonly related to implementation logistics than they were to the technical effectiveness of a particular technology. The lack of effective control of draught power continues to be a major constraint to crop production for a significant proportion of farmers.

5.2 END-OF-SEASON SURVEY RESULTS

5.2.1 Overview

An End-of-Season Survey consisting of nine different schedules (See Appendix B) was prepared. Schedule A was a general sheet for all interviewees, Schedule B was a general sheet for each trial, and the other seven schedules were for the specific trials. The survey was administered to 119 of the 143 farmers participating in the groups. Only farmers who had at least one successful trial were interviewed. Data were collected on 221 separate trials planned by farmers.[1] Because it was desirable to identify characteristics of the farmers in the groups which could be used in defining recommendation domains, data on farm households were analyzed in conjunction with the data collected during the End-of-Season Survey. Results of this analysis are presented below.

5.2.2 Characteristics of Farmer Group Members

Table 11 provides a summary of the farmer group members who were interviewed and the overall trials data by household characteristics. For much of the later analysis the age of head of household categories were compressed to three: Under 50, 50 to 60, and Over 60. The cattle catogories were compressed to two: 0 to 15 Head, and 16 or more Head. Those farmers using more than one draught source were classified by primary draught source, and how draught was acquired was divided by whether the farmer controlled (owned) the draught or was draught dependent.

As can be seen from Table 11 there was a reasonably equal division of respondents among villages. The same was true of trials, with Matobo and Marapong having slightly more than their proportional share of trials. If female and defacto female-headed households were combined, i.e., female decision makers, there was an almost equal split on male- and female-headed households and trials.

The age distribution indicated that there were more older farmers, 50 and above, in the group. If the households were divided into three categories, up to 50, 50 to 60, and over 60, the later group was slightly larger.

More than half of the farmers owned 1 to 15 head of cattle. A division of farmers into those owning less than 16 head and those owning 16 or more did not provide a balanced division of cattle ownership. However it is a relatively common division point and so was used for this study.

[1]. For trials attempted by farmers who were not interviewed, only data available on the agronomy trial sheet summary were used. At a minimum this included type of trial and whether it was implemented or not.

TABLE 11: DISTRIBUTION OF INTERVIEWEES AND NUMBER OF TRIALS BY HOUSEHOLD CHARACTERISTICS, TOTFG, FRANCISTOWN AREA, 1987-88

FACTOR	NUMBER OF HOUSEHOLDS	PERCENT OF HOUSEHOLDS	NUMBER OF TRIALS	PERCENT OF TRIALS
ALL HOUSEHOLDS	119	100	223	100
VILLAGE				
MATOBO	43	36	92	41
MATHANGWANE	43	36	50	23
MARAPONG	33	28	80	36
SEX HEAD OF HOUSE				
MALE	56	47	108	49
FEMALE	47	40	82	37
DEFACTO FEMALE	16	13	32	14
AGE HEAD OF HOUSE				
UNKNOWN	4	3	12	5
20-30	3	2	5	2
30-40	18	15	34	15
40-50	20	17	39	18
50-60	32	27	58	26
60-70	34	29	64	29
70-80	8	7	14	6
CATTLE CATEGORY				
NO CATTLE	12	10	25	11
1-15 CATTLE	62	52	104	47
16-40 CATTLE	32	27	67	30
41 OR MORE	13	11	26	12
DRAUGHT SOURCE				
UNKNOWN	1	1	4	2
DONKEY	5	4	5	2
CATTLE	89	75	179	81
TRACTOR	22	18	32	14
COMBINATION	2	2	3	1
CONTROL DRAUGHT				
UNKNOWN	1	1	4	1
OWN	74	62	153	69
HIRE	24	20	32	14
COOP	7	6	11	5
FAMILY	10	8	18	8
OWN/HIRE	1	1	2	1
HIRE/FAMILY	1	1	2	1
OWN/HIRE/FAMILY	1	1	1	1

As would be expected, cattle were the predominate draught source, and ownership was the predominate means of acquiring draught. The draught control catagories were divided into those controlling (owning) draught and those who were draught dependent (all other catagories).

In order to determine what significant differences there might be within the household characteristics, a table of cross-tabulations for the interviewed households was developed in which each of the household characteristics was cross-tabulated with the other characteristics (Table 12).

Based on the Chi-square statistic, there was a highly significant (P<.01) difference among villages for cattle categories, traction-type, and control of draught. Marapong participants appeared to have significantly more cattle and to control their draught more often than the other two villages. Matobo farmers tended to rely on cattle for traction while Mathangwane farmers made more use of tractors.

There were significant (P<.01) differences among households, categorized by sex of head of household, with respect to age of head of household, cattle control and control of draught. Male household heads were significantly older than female household heads, particularly defacto female heads who tended to be under 50. Female-headed households owned significantly fewer cattle than did both male and defacto female households, and, not unexpectedly, female heads of households were also significantly more draught dependent.

Use of tractor draught was used predominately by the head of households aged 50 to 60, while the households with heads over 60 and under 50 used cattle draught. There was also a significant (P<.01) difference in control of draught between those who owned 16 or more cattle (and controlled draught) and those owning less than 16 head, who were more often draught dependent. Finally, there was a not unexpected significant difference between types of draught used and draught control, with those using cattle and donkeys controlling their draught and those using tractors being more draught dependent.

Some additional characteristics of the interviewed households were of interest. These included the composition of the household labour force active in agriculture, the total number of household members and the average number of donkeys owned. More detailed information on draught acquisition may also be helpful in understanding the farming household constraints. Table 13 presents this information on secondary household characteristics.

Analysis of Variance procedures were used to obtain an indication of significant differences among the mean numbers of household members, by categories, and the mean numbers of donkeys for all households and for those households owning some donkeys.

Marapong households had significantly more males, children, total members active in agriculture, and total household members, than did the other villages. In addition, Marapong farmers owned significantly more donkeys than did farmers in the other villages. Mathangwane farmers appeared to be more dependent on hired draught than did farmers in the other villages, while Matobo farmers seemed to use more of the traditional cooperative and family traction access systems than did the other villages.

Female-headed households had significantly less male labour and also significantly fewer donkeys. They also appeared to be more dependent on hired draught. Older households (heads over 60) had significantly more male, female and total agricultural labour available to them, while the households with heads aged 50 to 60 had significantly more total household members. The over 60 households appear to depend on owned draught more than the other groups.

TABLE 12: CROSS-TABULATION OF INTERVIEWED HOUSEHOLDS BY HOUSEHOLD CHARACTERISTICS, TOTFG, FRANCISTOWN AREA, 1987-88

FACTOR	SEX HH			AGE HH			NO CATT		TRACTION TYPE			CONTROL DRA		TOTAL
	MALE	FEM	DEF	<50	50-60	>60	0-15	>16	DONK	CAT	TRA	CONT	NOT	NUMB HH
	PERCENTAGE													
ALL HOUSEHOLDS (NUMBER)	58	47	16	41	32	42	74	45	6	90	22	78	43	119
VILLAGE (%) [a]														
MATOBO	56	33	11	36	15	49	67	33	2	98	0	65	35	43
MATHANGWANE	42	49	9	30	40	30	74	26	9	54	37	47	53	43
MARAPONG	42	37	21	43	27	30	39	61	3	78	19	85	15	33
SEX HEAD OF HOUSE(%) [b]														
MALE				20	28	52	54	46	4	80	16	73	27	56
FEMALE				41	33	26	81	19	4	72	24	47	53	47
DEFACTO FEMALE				74	13	13	38	62	13	75	12	81	19	16
AGE HEAD OF HOUSE (%) [c]														
LESS THAN 50							68	32	5	83	12	56	44	41
50-60							68	32	3	58	39	56	44	32
MORE THAN 60							50	50	7	81	12	79	21	42
CATTLE CATEGORY (%) [d]														
0-15 CATTLE									6	75	19	47	53	74
16 OR MORE									[illegible]	70	18	91	9	45
DRAUGHT SOURCE (%) [e]														
DONKEY												83	17	6
CATTLE												73	27	90
TRACTOR												23	77	22

a. Chi-square statistic showed a highly significant (P<.01) difference among villages for cattle number, traction-type, and control of draught.

b. Chi-square statistic showed highly significant (P<.01) differences among sexes of heads of households for age of head of household, cattle number, and control of draught.

c. Chi-square statistic showed significant (P<.05) differences among age categories for traction-types.

d. Chi-square statistic showed highly significant (P<.01) differences among cattle categories for control of draught.

e. Chi-square statistic showed a highly significant (P<.01) difference between traction categories for control of draught.

TABLE 13: DISTRIBUTION OF SECONDARY HOUSEHOLD CHARACTERISTICS, TOTFG, FRANCISTOWN AREA, 1987-88

	AVERAGE NO PER HH ACTIVE IN AGRI [a]				AVG TOT HHM [b]	AVG NO DONKEYS		(PERCENT OF HH) DRAUGHT ACQUIRED					TOTAL NUMBER HH
	MALE	FEM	CHILD	TOT		ALL	SOME [c]	OWN	HIRE	COOP	FAM	COMB	
ALL HOUSEHOLDS	0.8	1.6	1.1	3.5	8.1	1.8	4.2	74	24	7	10	3	119
VILLAGE [d]													
MATOBO	0.5	1.5	0.8	2.8	7.7	0.8	3.7	63	5	9	18	5	43
MATHANGWANE	0.8	1.5	0.8	3.1	7.4	0.7	4.0	44	42	7	5	2	43
MARAPONG	1.3	1.7	1.9	4.9	9.5	2.5	4.6	88	12	0	0	0	33
SEX HEAD OF HOUSE [e]													
MALE	1.1	1.6	1.2	3.9	8.6	1.6	4.6	73	9	9	7	2	56
FEMALE	0.5	1.6	0.9	3.0	7.2	0.5	3.4	44	37	4	11	4	47
DEFACTO FEMALE	1.0	1.5	1.2	3.7	8.6	2.0	4.0	81	13	0	6	0	16
AGE HEAD OF HOUSE [f]													
LESS THAN 50	0.5	1.2	0.7	2.4	7.3	1.0	4.2	54	17	5	15	5	41
50-60	0.9	1.6	1.1	3.6	9.5	1.3	4.6	58	32	10	0	0	32
MORE THAN 60	1.1	2.0	1.6	4.7	8.2	1.5	4.1	78	10	5	2	2	42
CATTLE CATEGORY [g]													
0-15 CATTLE	0.6	1.5	0.9	3.0	7.6	0.7	3.7	48	27	10	14	3	74
16 OR MORE	1.2	1.6	1.4	4.2	8.8	2.0	4.6	89	9	0	0	2	45
PRIMARY DRAUGHT SOURCE [h]													
DONKEY	1.3	1.7	1.2	4.2	8.0	3.7	4.4	67	17	0	0	17	6
CATTLE	0.8	1.6	1.2	3.6	8.3	1.1	4.0	72	7	8	11	2	90
TRACTOR	0.9	1.4	0.9	3.2	7.1	1.2	5.4	23	77	0	0	0	22
CONTROL DRAUGHT [i]													
CONTROL DRAUGHT	1.0	1.7	1.3	4.0	9.1	1.6	4.1	97	0	0	0	3	76
DRAUGHT DEPENDENT	0.5	1.3	0.8	2.6	6.4	0.5	5.2	0	57	17	24	2	43

a. Average number of household members active in agriculture.
b. Average number of total household members.
c. Average number of donkeys where ALL = all households and SOME = households owning donkeys.
d. Analysis of variance procedure indicated highly significant differences (P<.01) among villages for mean number of males, children, total active in agriculture, and all donkeys. Average total household members were significantly different (P<.05) among villages.
e. Analysis of variance indicated highly significant differences (P<.01) among sex of head of household categories for mean number of males and the average number of donkeys for all respondents.
f. Analysis of variance indicated highly significant differences (P<.01) among age of head of household categories for mean number of females and total active in agriculture. Average males and average total household members were significantly different (P<.05) among age of head of household categories.
g. Analysis of variance indicated highly significant differences (P<.01) among cattle ownership categories for mean number of males and the average number of donkeys for all respondents.
h. Analysis of variance indicated a significant difference (P<.05) among draught source categories for average number of donkeys for all respondents.
i. Analysis of variance indicated highly significant differences (P<.01) between draught control categories for mean number of males, children, total active in agriculture, total household members, and average number of donkeys for all respondents. Average females per household members were significantly different (P<.05) between draught control categories.

Owners of 16 or more cattle had significantly more male labour and total household members. Predictably they also depended on owned draught to a much higher degree than the group owning 0 to 15 head of cattle. As might be expected those using donkey draught owned significantly more donkeys than those in the other traction using categories who owned donkeys. Finally, those families who controlled their draught had significantly more members in all categories than did draught dependent families, and they also owned significantly more donkeys.

5.2.3 Summary of Participation in Group Meetings

Of the 70 farmers responding to the questions on group meetings, only 10 percent did not participate in the meetings. One farmer indicated that the meetings were not helpful because she felt too much material was repeated in the monthly meetings. For those who answered the question on how the meetings were helpful, the answers generally fell into three categories:

(a). Farmers could discuss problems with ATIP staff.
(b). Members could share ideas and experiences with other farmers.
(c). Participants could receive information on new technologies and ideas on how to improve their agricultural practices.

All but one of the farmers indicated that they would participate in the groups during the following cropping season.

Table 14 provides more detailed information, by household characteristics, on those who did not participate in the meetings and the benefits received by those who did participate. Generally, those who did not participate were from female-headed households, were from Mathangwane, had no cattle, and were in the 50 to 60 age group. They tended to use tractor draught power and as such were draught dependent.

The access to new technologies and ideas was most important for Matobo households, for males, and for those owning 16 or more cattle. Sharing ideas with others was relatively more important for Mathangwane farmers and for female-headed households. Discussing trial implementation was most important for those using tractor draught.

5.2.4 Summary of Trial Data

Information on the trials undertaken has been presented in the agronomy section. That information was based on ATIP trial records. This discussion of trials is based on the farmer's perceptions of the trials as reported during the End-of-Season Survey. Because of differences in ATIP staff and farmer perceptions of trials, there may be some differences between the earlier agronomic discussion and the present discussion. For some trial categories there is a discrepancy between the number of trials recorded in the agronomic discussion above and the data collected during the End-of-Season Survey. There are two reasons for this:

(a). Data were not collected in the End-of-Season survey for all trials recorded on the agronomic data sheets because some farmers were not available, i.e., they had temporarily left the community.

(b). Some farmers reported trials that they never implemented, and since they had not collected seed for the trials, there was no agronomic record on the trial.

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TABLE 14: PARTICIPATION AND USEFULNESS OF MEETINGS BY HOUSEHOLD CHARACTERISTICS, TOTFG, FRANCISTOWN AREA, 1987-88

FACTOR	DID NOT PARTICIPATE MEETING [a] PERCENT	HOW DID MEETING HELP: DISCUSS [b]	SHARE [c]	NEW [d]	OTHER [e]
		PERCENT BY FACTOR			
TOTAL RESPONSES (NUMBER)	70	13	16	28	2
VILLAGE (%)					
MATOBO	4	5	10	81	5
MATHANGWANE	20	31	50	19	0
MARAPONG	8	35	30	30	5
SEX HEAD OF HOUSE (%)					
MALE	5	21	23	56	0
FEMALE	20	28	19	22	11
DEFACTO FEMALE	0	20	20	60	0
AGE HEAD OF HOUSE (%)					
UNDER 50	5	19	24	43	0
50-60	19	31	31	12	6
OVER 60	11	14	21	46	0
CATTLE CATEGORY (%)					
NO CATTLE	40	50	50	0	0
1-15 CATTLE	9	17	33	43	7
16-40 CATTLE	5	22	28	50	0
41 OR MORE	10	43	0	57	0
DRAUGHT SOURCE (%)					
DONKEY	0	0	0	100	0
CATTLE	7	13	30	53	4
TRACTOR	17	78	22	0	0
CONTROL DRAUGHT (%)					
CONTROL DRAUGHT	8	20	25	52	3
DRAUGHT DEPENDENT	14	29	35	29	6

a. Did NOT participate in farmer group meeting.
b. Able to discuss problems with staff.
c. Could share ideas with other farmers.
d. Received information on new technologies and ideas.
e. Other: double ploughing is better than single ploughing.

For each trial, information was collected from the farmer on the crop planted, his/her reason for choosing the trial, and what she/he perceived as benefits. For those trials that failed, information was collected on when the trial failed and the general reason for the failure. This information, reported by trial-type, is summarized in Table 15.

TABLE 15: FARMER REPORTED EXPERIENCES WITH TRIALS, TOTFG, FRANCISTOWN AREA, 1987-88

	DP VS SP	LONG/SHORT SEASON	COWPEA VARIETY	ROW PLANT	FERTI-LIZER	GROUND NUTS	ALL TRIALS
	PERCENT OF TRIALS						
TOTAL TRIALS (NUMBER) [a]	92	18	30	11	8	59	218
CROP PLANTED (NUMBER) [b]	85	18	29	7	6	59	200
SORGHUM (%)	21	88	0	0	50	0	17
MAIZE (%)	1	6	0	0	17	0	2
MILLET (%)	31	0	0	29	17	0	15
COWPEAS (%)	47	6	100	71	17	0	38
GROUNDNUTS (%)	0	0	0	0	0	100	29
REASON CHOOSE TRIAL (NUMBER) [b]	44	11	20	7	5	40	128
SEE IF IT COULD WORK (%)	86	36	50	43	83	82	73
LIKE THE CROP (%)	0	0	5	0	17	10	5
WHICH MATURES QUICKER (%)	2	46	15	0	0	0	8
WHICH PRODUCES MORE (%)	11	18	15	0	0	5	9
OTHER [c] (%)	0	0	15	57	0	0	6
PERCEIVED BENEFITS (NUMBER) [b]	10	8	10	6	3	19	56
GREATER YIELD (%)	60	38	50	83	67	74	61
BETTER PLANTS [d] (%)	10	0	30	0	33	5	10
MATURES QUICKER (%)	10	25	20	17	0	5	12
PRODUCED SOMETHING (%)	10	25	0	0	0	10	9
OTHER [e] (%)	10	12	0	0	0	5	7
TRIAL FAILED (% OF TOTAL)	38	67	30	9	0	30	35
WHEN FAILED (% OF TOTAL)							
BEFORE PLOUGHING	14	33	17	9	0	15	[illegible]
BEFORE PLANTING	0	17	3	0	0	2	
BEFORE WEEDING	4	6	3	0	0	2	[illegible]
BEFORE HARVESTING	14	11	3	0	0	13	12
REASON FAILED (NUMBER) [b]	23	10	6	1	0	11	51
PLOUGH LATE/POOR GERMIN (%)	26	20	17	0	0	27	22
INSECTS/BIRDS (%)	13	10	0	0	0	0	9
WATER LOGGING (%)	0	10	33	0	0	18	9
DROUGHT (%)	0	10	0	0	0	9	4
LACK OF TRACTION (%)	26	40	50	0	0	27	33
IMPLEMENTATION PROBLEM [f] (%)	35	10	0	100	0	18	24

a. Number of trials reported here does not agree with number in Table 2 because information was not collected on some trials, and farmers reported some trials for which they never collected seed, and thus were not included in the records used in Table 2.
b. Number of responses to this question. Percentages based on these responses.
c. Other reasons included: knew trial would succeed, used less labour, see which variety tastes better, only trial farmer could manage, and wanted to row plant.
d. Plants looked better, tasted better or gave more leaves.
e. Other reasons included: better to plant long and short season varieties, less insect problems, and seed for next season.
f. Trials produced yield but were not implemented as a valid trial, e.g., both plots of DP trial were single ploughed due to tractor driver problems, etc.

Double ploughing vs single ploughing was the most common trial followed by groundnut trials. It is interesting that cowpeas were chosen more frequently than other crops for the double ploughing and row planting trials. This may be because cowpeas are considered a high value crop and so it was worth investing extra work in their production. The major perceived benefit from the double ploughing and row planting trials was increased yield, which would support the idea that extra work was worth the time for high value crops. Increased yield was, in fact, the most prevalent perceived benefit for all trials.

About one-third of the trials failed. Failures ranged from zero for fertilizer trials to 67 percent for the long/short season variety trials. Trial failures generally occurred before ploughing (mostly due to a lack of traction) or after weeding, but before harvesting. Implementation problems, which did not necessarily reflect a complete lack of yield but rather a non-valid trial, were the next most common reason for failure. Implementation problems were generally researcher identified, so in some cases the farmer was quite happy with the harvest, but there was no trial.

In attempting to identify potential recommendation domains for the different types of trials, it is useful to look at the household characteristics of those farmers who showed an interest in a trial by choosing to undertake the trial. Table 16 summarizes the trials data by household characteristic.

Double ploughing appeared to be most popular in Matobo, with those who owned 0 to 15 cattle, with cattle draught power users, and with those who controlled their own draught. Double ploughing is a technology which requires an additional traction operation, thus it would be natural that it would be more attractive to those who controlled their own draught. In addition, it is an easily implemented technology and as such may suit the more traditional setting of Matobo. Also the technology may have greater application for cattle draught users as it may be easier for them to acquire the extra draught. This seemed to be true for Matobo where almost all participants used cattle for draught.

The long and short season varieties appeared to be of greater interest in Marapong which is a more progressive village. Again the technology seemed to appeal more to cattle draught users and to draught controlling farmers. This is possibly because these groups had better control over their draught and so could implement the trial when they had the opportunity.

Cowpea variety trials were also favoured by Marapong farmers. They were chosen by those owning more than 16 head of cattle, by those using cattle draught and by those controlling draught. Since cowpeas are generally considered a more valuable crop, they could be more attractive to those farmers who have a better resource base for their farming, or it could be that the implementers were just more cash-crop oriented.

Row planting trials were popular in Mathangwane, a village where hired tractor ploughing was important because of a lack of labour to train and work animals. Row planting was most popular with female-headed households, with those owning few cattle and proportionally more with those using tractor draught. It was definitely favoured by draught dependent households. Thus row planting appears to have been a technology which was useful for the more resource limited households (which tend to be female-headed), and was compatible with tractor hire. In most cases, hand row planters were used. This may represent an attempt to better control the timing of planting operations, since the precise arrival times of hired tractors did not always coincide with periods of good soil moisture for planting.

TABLE 16: DISTRIBUTION OF TRIALS BY HOUSEHOLD CHARACTERISTICS, TOTFG, FRANCISTOWN AREA, 1987-88

	GP VS SP	LONG/SHORT SEASON	COWPEA VARIETY	ROW PLANT	FERTI-LIZER	GROUND NUTS	ALL TRIALS
	PERCENT OF TRIALS BY FACTOR						
TOTAL TRIALS (NUMBER) *	92	18	30	11	8	59	218
VILLAGE (%)							
MATOBO	74	0	21	0	25	24	41
MATHANGWANE	7	28	10	91	63	29	23
MARAPONG	13	72	69	9	12	47	36
SEX HEAD OF HOUSE (%)							
MALE	55	55	41	27	38	42	49
FEMALE	32	28	41	73	37	41	37
DEFACTO FEMALE	13	17	17	0	25	17	14
AGE HEAD OF HOUSE (%)							
UNDER 50	37	40	41	18	25	30	35
50-60	23	22	24	36	25	25	25
OVER 60	32	38	35	27	50	39	35
CATTLE CATEGORY (%)							
NO CATTLE	8	6	10	36	25	12	11
1-15 CATTLE	44	39	31	46	62	42	47
16-40 CATTLE	28	39	38	18	13	36	30
41 OR MORE	12	16	21	0	0	10	12
DRAUGHT SOURCE (%)							
DONKEY	1	6	0	0	0	2	2
CATTLE	91	72	83	64	62	78	82
TRACTOR	6	22	14	36	38	19	14
CONTROL DRAUGHT (%)							
CONTROL DRAUGHT	67	78	79	36	50	76	70
DRAUGHT DEPENDENT	33	22	21	64	50	24	30

a. Number of trials reported here does not agree with number in Table 2 because information was not collected on some trials, and farmers reported some trials for which they never collected seed, and thus were not included in the records used in Table 2.

Fertilizer was of most interest to Mathangwane farmers, and to farmers with less than 16 head of cattle. It was also of proportionally greater interest to tractor draught users and to those who were draught dependent. The interest in this technology by limited resource farmers may be because it can be implemented without controlling draught.

Groundnut seed treatments were very popular in Marapong, the more progressive village. This trial appealed to many farmers because it was an easy trial to implement (requiring no additional tillage operations) and produced a high value product, one for which seeds were often in short supply.

The number of trials that farmers attempted may be of interest. There was a highly significant difference between the average number of trials implemented by village, with Mathangwane attempting significantly less trials. Sixty-one percent of Mathangwane group members attempted only one trial, whereas over 75 percent of the group members in the other two village tried either two or three trials (Table 17). This was probably due, in part, to the problems of obtaining draught in Mathangwane. Farmers using cattle for draught planted more trials on average than did other draught users, and those who controlled their own draught planted significantly more trials than those who were draught dependent.

5.2.5 Data on Individual Types of Trials

This section contains information on the individual types of trials. A summary of interview responses is provided for each trial. Where there was sufficient variability in answers, a breakdown of key variables by household characteristic is also provided.

5.2.5.1 Double Ploughing vs. Single Ploughing Trials

Table 18 tabulates the responses for the questionnaire on the double ploughing trials. The responses were generally consistent with farmer attitudes from prior years. One surprising result was that only 23 percent of the farmers indicated that they felt the additional yield was worth the extra effort required to perform double ploughing. This was not the case in other surveys and does not correspond with the answers as to whether farmers wished to try DP again next year and whether they planned to adopt DP on other parts of their fields. Thus it is possible that this question was not being properly phrased during the interviews, or that the latter two questions were not receiving honest answers.

ATIP's general recommendation for implementing DP is to do the first ploughing on drying soil moisture, so as not to interfere with single plough planting when there is sufficient moisture. Thirty-nine percent of the respondents indicated that they ploughed the first time on soil that was too dry to plant. The majority of farmers (57 percent) planted cowpeas. This emphasis on cowpeas, a high value crop, probably contributed to the relatively high percentage (25 percent) of farmers who row planted. The use of cowpeas also probably contributed to the high incidence of insect pests reported.

TABLE 17: DISTRIBUTION OF NUMBER OF TRIALS BY HOUSEHOLD CHARACTERISTICS, TOTFG, FRANCISTOWN AREA, 1987-88

	1 TRIAL		2 TRIALS		3 TRIALS		4 TRIALS		MEAN NO TRIALS	STND. DEV.	TOTAL N OUSEHOLD
	NO	%	NO	%	NO	%	NO	%			
ALL HOUSEHOLDS	35	29	51	43	26	22	7	6	2.04	0.87	119
VILLAGE [a]											
MATOBO	6	14	26	61	7	16	4	9	2.21	0.80	43
MATHANGWANE	26	61	11	22	5	12	1	2	1.56	0.80	43
MARAPONG	3	9	14	42	14	42	2	6	2.45	0.75	33
SEX HEAD OF HOUSE											
MALE	12	21	28	50	13	23	3	5	2.12	0.81	56
FEMALE	18	38	18	38	9	19	2	4	1.89	0.87	47
DEFACTO FEMALE	5	31	5	31	4	25	2	13	2.19	1.05	16
AGE HEAD OF HOUSE											
20-30	1	33	1	33	1	33	0	0	2.00	1.00	3
30-40	4	22	13	72	0	0	1	6	1.89	0.68	18
40-50	4	20	11	55	3	15	2	10	2.15	0.88	20
50-60	13	41	11	34	7	22	1	3	1.87	0.87	32
60-70	10	29	10	29	12	35	2	6	2.18	0.94	34
70-80	3	37	3	37	2	25	0	0	1.87	0.85	8
CATTLE CATEGORY											
NO CATTLE	3	25	5	42	3	25	1	8	2.17	0.94	12
1-15 CATTLE	22	35	25	40	12	19	3	5	1.94	0.97	62
16-40 CATTLE	7	22	14	44	10	31	1	3	2.16	0.81	32
41 OR MORE	3	23		54	1	8	2	15	2.15	0.99	13
DRAUGHT SOURCE [b]											
DONKEY	3	60	2	40	0	0	0	0	1.40	0.55	5
CATTLE	19	21	43	48	22	25	5	6	2.15	0.82	89
TRACTOR	12	54	5	23	3	14	2	9	1.77	1.02	22
COMBINATION	1	50	1	50	0	0	0	0	1.50	0.50	2
CONTROL DRAUGHT											
CONTROL DRAUGHT [c]	16	21	34	45	21	28	5	6	2.20	0.85	76
DO NOT CONTROL [d]	19	44	17	39	5	12	2	5	1.77	0.84	43

a. Highly significant differences for mean number of trials among villages at P<.01 level.
b. Significant difference for mean number of trials between control types at P<.05 level.
c. Owned draught.
d. Hired, cooperative arrangement, or family supplied draught.

TABLE 18: SUMMARY OF RESPONSES, DOUBLE PLOUGHING VS SINGLE PLOUGHING TRIAL, TOTFG, FRANCISTOWN AREA, 1987-88 [a]

FACTOR	SUMMARY OF RESPONSES
TAKE LESS TIME TO PLOUGH SECOND TIME	YES = 42; NO = 2
SOIL MOISTURE ON PLOT AT PLOUGHING	
1ST PLOUGHING - TRIAL PLOT	OPTIMAL = 27; TOO DRY = 17
2ND PLOUGHING - TRIAL PLOT	OPTIMAL = 36; TOO DRY = 2; TOO WET = 4
TRADITIONAL CHECK PLOT	OPTIMAL = 36; TOO DRY = 4; TOO WET = 4
WHICH PLOT HAD GREATER YIELD	DP = 39; SP = 3; SAME = 2
IF DP PLOTS HAD GREATER YIELD, WAS THE EXTRA YIELD WORTH THE EXTRA EFFORT	YES = 10; NO = 34
ROW PLANTED	YES = 11; NO = 33
CONDITIONS WHEN ROW PLANTED	
TRIAL PLOT	OPTIMAL = 11
CHECK PLOT	OPTIMAL = 11
NUMBER OF PLANTS IN TRIAL PLOT GREATER THAN TRADITIONAL CHECK	GREATER = 29; LESS = 4; SAME = 11
PLANTS GREW FASTER OR SLOWER IN TRIAL PLOT	FASTER = 35; SLOWER = 2; SAME = 7
RE-PLANT	YES = 4; NO = 40
WHICH PLOTS WERE RE-PLANTED	TRIAL = 0; TRADITIONAL = 3; BOTH = 1
THIN	YES = 4; NO = 40
WHICH PLOTS WERE THINNED	TRIAL = 1; TRADITIONAL = 0; BOTH = 3
DIFFERENCE IN KINDS OF WEEDS BETWEEN PLOTS	YES = 13; NO = 31
PROBLEM WEEDS	17 DIFFERENT PROBLEM WEEDS WERE REPORTED
PROBLEM WEEDS IN FIELD LAST YEAR	YES = 30; NO = 14
OTHER PROBLEMS	INSECTS = 21 PLOUGHING PROBLEMS (LACK OF DRAUGHT) = 8 OTHER PESTS = 13 LACK OF RAIN - POOR GERMINATION = 2 IMPLEMENTATION (NOT A VALID TRIAL) = 11
TRY SYSTEM AGAIN NEXT YEAR	YES = 42; NO = 2
PLAN TO USE SYSTEM ON LARGER PART OF FIELD (ADOPT)	YES = 41; NO = 3
CROP PLANTED	SORGHUM = 7; MAIZE = 1; MILLET = 11; COWPEAS = 25

a. Number of respondents = 44.

Table 19 provides a cross-tabulation of selected variables in the DP trial survey by household characteristics. It is interesting that row planting was relatively more important in Matobo, a village not normally known for row planting. This may be because of the high percentage of cowpeas planted in DP trials. Cowpeas are a high value crop and so farmers were often willing to take more effort in their husbandry. While many of the 17 problem weeds reported were found in all villages, Mathangwane farmers reported a relatively high number of weed problems while Matobo farmers reported a low number. Female-headed households reported a proportionally higher incidence of plough/planting of both the trial and traditional check plots under less than optimal soil moisture conditions, possibly reflecting draught constraints.

A number of problems were identified by the farmers. These are tabulated by household characteristic in Table 20. Male-headed households reported a high incidence of "other pests" while female-headed households reported 75 percent of the ploughing problems, mostly obtaining draught. The two younger age groups for heads of households were also the groups with ploughing problems.

5.2.5.2 Long and Short Season Stability Trials

There were ten questionnaires covering long and short season stability trials. The summary of responses to the questionnaire on these trials are presented in Table 21. A cross-tabulation of selected variables by household characteristics is presented in Table 22, while Table 23 contains a cross-tabulation of reasons for trial failure by household characteristics. Sorghum was the most popular crop for this trial, with one farmer adding maize and two adding cowpeas to the mix. Marapong farmers reported earlier planting (which actually occurred in December) while Mathangwane farmers reported late plantings. Draught dependant females in the under 50 age group seem to have dominated the late plantings. This is also the group who reported the highest number of trial failures due to a lack of draught. These farmers were from Marapong and slightly more dependent on tractor than the group reporting late plantings.

5.2.5.3 Cowpea Variety Trials

Questionnaires were completed for 19 farmers who participated in the cowpea variety trials. The summary of responses to the cowpea variety trial questionnaire, broken down by variety, is presented in Table 24. TVX was the variety farmers thought had the most plants and was the most vigourous, followed by ER7. However, farmers liked Blackeye best for taste and B005C for yield. The greater yield of B005C was probably attributable to the fact that it matured later than the other varieties and so was not as badly damaged by insects. TVX received most complaints due to bad taste, while B005C was faulted for slow maturity. Farmers were very interested in planting Blackeye again and least interested in TVX.

5.2.5.4 Row Planting vs. Broadcast Planting Trials

Seven farmers who participated in the row planting versus broadcast planting trial were interviewed. Table 25 provides a summary of their responses to the row planting questionnaire. The Sanitas planter was the most frequently used planter during this season. All but one of the respondents was from Mathangwane. Those farmers using the hand row planters were female heads of households, in the younger age groups, with fewer than 15 head of cattle, and were draught dependent, with more than half using tractor traction. This group had the

characteristics of the most resource poor farmers, who generally had draught problems and could most benefit from the hand row planter technology. On the other hand, the farmers who used the Sebele planter were older male household heads who owned their own traction. Thus there appear to be two distinct recommendation domains for the different types of row planters.

TABLE 19: CROSS-TABULATIONS OF SELECTED VARIABLES BY HOUSEHOLD CHARACTERISTICS, DOUBLE PLOUGHING VS SINGLE PLOUGHING TRIAL, TOTFG, FRANCISTOWN AREA, 1987-88

FACTORS	NON-OPTIMAL SOIL MOISTURE: TRIAL 1ST PLOW	TRIAL 2ND PLOW	CHECK PLOW	DP WORTH EFFORT	ROW PLANT	PROBLEM WEEDS	TOTAL RESPONSES BY FACTOR
	PERCENTAGES POSITIVE RESPONSES						
TOTAL OBSERVATIONS (NUMBER)	17	6	8	10	17	13	44
VILLAGE (%)							
MATOBO	59	50	37	0	78	38	66
MATHANGWANE	29	17	25	10	12	38	11
MARAPONG	12	33	38	90	12	24	23
SEX HEAD OF HOUSE (%)							
MALE	76	33	25	80	65	69	61
FEMALE	18	67	75	30	23	31	25
DEFACTO FEMALE	6	0	0	10	12	0	14
AGE HEAD OF HOUSE (%)							
UNDER 50	53	33	25	10	53	46	39
50-60	19	33	62	70	23	39	29
OVER 60	29	34	13	[illegible]	24	15	32
CATTLE CATEGORY (%)							
0-15 CATTLE	77	83	87	50	65	85	66
16 OR MORE	23	17	13	50	35	15	34
DRAUGHT SOURCE (%)							
DONKEY	0	0	0	0	6	0	2
CATTLE	94	100	75	40	88	85	84
TRACTOR	6	0	25	60	6	15	14
CONTROL DRAUGHT (%)							
CONTROL DRAUGHT [a]	41	67	37	60	71	39	54
DRAUGHT DEPENDENT [b]	59	33	63	40	29	61	46

a. Owned draught.
b. Hired, cooperative arrangement, or family supplied draught.

TABLE 20: CROSS-TABULATIONS OF PROBLEMS BY HOUSEHOLD CHARACTERISTICS, DOUBLE PLOUGHING VS SINGLE PLOUGHING TRIAL, TOTFG, FRANCISTOWN AREA, 1987-88

FACTOR	INSECTS	PLOUGH PROBLEMS [a]	OTHER PESTS	LACK RAIN/ GERMIN	IMPLE-MENT-ATION	TOTAL RESPONSES BY FACTOR
	PERCENTAGES					
TOTAL OBSERVATIONS (NUMBER)	21	8	13	2	11	60
VILLAGE (%)						
MATOBO	62	75	70	50	46	63
MATHANGWANE	14	0	15	0	18	12
MARAPONG	24	25	15	50	36	25
SEX HEAD OF HOUSE (%)						
MALE	57	12	77	50	54	55
FEMALE	24	75	23	50	38	32
DEFACTO FEMALE	19	13	0	0	9	13
AGE HEAD OF HOUSE (%)						
UNDER 50	38	50	46	0	45	41
50-60	29	38	23	50	18	27
OVER 60	33	12	31	50	37	32
CATTLE CATEGORY (%)						
0-15 CATTLE	67	87	85	100	73	70
16 OR MORE	33	13	15	0	27	30
DRAUGHT SOURCE (%)						
DONKEY	5	0	0	0	0	2
CATTLE	86	88	85	100	100	87
TRACTOR	9	12	15	0	0	11
CONTROL DRAUGHT (%)						
CONTROL DRAUGHT [b]	57	50	38	0	54	53
DRAUGHT DEPENDENT [c]	43	50	62	100	46	47

a. Primarily lacked access to traction.
b. Owned draught.
c. Hired, cooperative arrangement, or family supplied draught.

TABLE 21: SUMMARY OF RESPONSES, LONG AND SHORT SEASON STABILITY TRIAL, TOTFG, FRANCISTOWN AREA, 1987-88 [a]

FACTOR	SUMMARY OF RESPONSES
CROP VARIETIES PLANTED	SORGHUM: SEGAOLANE = 10; TOMM = 10; 65D = 10 MAIZE: A.E.P. = 1; v. 308 = 1; v. 7522 = 1 COWPEAS: ER7 = 2; BLACKEYE = 2
WHEN CROP WAS PLANTED	EARLY [b] = 4; MID-SEASON 3; LATE 3
ALL CROPS MATURED	YES = 6; NO = 4
REASONS FOR CROP FAILURE (n=22)	WATER LOGGING = 6 PLOUGHED LATE = 4 TOO MUCH HEAT/SUN = 2 LACKED DRAUGHT POWER = 10
DID ANY CROP RIPEN TOO EARLY AND GET DAMAGED BY RAIN	YES = 4; NO (NO RESPONSE) = 5
DIFFERENT MATURITY LENGTHS HELP REDUCE RISK OF COMPLETE CROP FAILURE	YES = 8; NO = 1
PLANTING CROPS OF DIFFERENT MATURITY LENGTHS IS A GOOD IDEA	YES = 10
RE-PLANT	YES = 1; NO = 9
THIN WHICH VARIETIES WERE THINNED	YES = 2; NO = 8 SEGAOLANE = 1; TOMM = 1
DIFFERENCE IN KINDS OF WEEDS BETWEEN PLOTS	YES = 1; NO = 10
PROBLEM WEEDS IN FIELD LAST YEAR	YES = 1; NO = 3
OTHER PROBLEMS	INSECTS, BIRDS OR GRASSHOPPERS = 8 IMPLEMENTATION (NO TRIAL) = 1
TRY SYSTEM AGAIN NEXT YEAR	YES = 10
PLAN TO USE SYSTEM ON LARGER PART OF FIELD (ADOPT)	YES = 10

a. Number of respondents = 10.
b. Earliest plantings were in December, for crops that matured.

TABLE 22: CROSS-TABULATIONS OF SELECTED VARIABLES BY HOUSEHOLD CHARACTERISTICS, LONG AND SHORT SEASON STABILITY TRIAL, TOTFG, FRANCISTOWN AREA, 1987-88

FACTOR	WHEN WAS PLOUGHING DONE: EARLY	MID-SEASON	LATE	ALL MATURE	EARLY RAIN DAMAGE	INSECT AND BIRDS	TOTAL # RESPONSES BY FACTOR
	PERCENTAGES						
TOTAL OBSERVATIONS (NUMBER)	4	3	3	6	4	8	10
VILLAGE (%)							
MATOBO	0	0	0	0	0	0	0
MATHANGWANE	25	33	67	50	50	38	40
MARAPONG	75	67	33	50	50	62	60
SEX HEAD OF HOUSE (%)							
MALE	75	100	0	67	100	62	60
FEMALE	0	0	67	33	0	13	20
DEFACTO FEMALE	25	0	33	0	0	25	20
AGE HEAD OF HOUSE (%)							
UNDER 50	25	0	100	33	0	37	40
50-60	50	0	0	33	25	13	20
OVER 60	25	100	0	34	75	50	40
CATTLE CATEGORY (%)							
0-15 CATTLE	25	33	67	67	25	37	40
16 OR MORE	75	67	33	33	75	63	60
DRAUGHT SOURCE (%)							
DONKEY	0	0	0	0	0	0	0
CATTLE	75	100	67	67	100	87	80
TRACTOR	25	0	33	33	0	13	20
CONTROL DRAUGHT (%)							
CONTROL DRAUGHT [a]	100	100	33	60	100	87	80
DRAUGHT DEPENDENT [b]	0	0	67	40	0	13	20

a. Owned draught.
b. Hired, cooperative arrangement, or family supplied draught.

TABLE 23: CROSS-TABULATIONS OF REASONS FOR FAILURES BY HOUSEHOLD CHARACTERISTICS, LONG AND SHORT SEASON STAB LITY TRIAL, TOTFG, FRANCISTOWN AREA, 1987-88

FACTOR	WATER LOGGING	PLOUGHED LATE	TOO MUCH SUN	LACKED DRAUGHT	TOTAL RESPONSES BY FACTOR
	PERCENTAGES				
TOTAL OBSERVATIONS (NUMBER) [a]	6	4	2	10	22
VILLAGE (%)					
MATCBO	0	0	0	0	0
MATHANGWANE	33	50	100	0	27
MARAPONG	77	50	0	100	73
SEX HEAD OF HOUSE (%)					
MALE	0	75	100	30	36
FEMALE	0	0	0	30	14
DEFACTO FEMALE	100	25	0	40	50
AGE HEAD OF HOUSE (%)					
UNDER 50	17	25	0	70	41
50-60	0	0	0	30	14
OVER 60	83	75	100	0	45
CATTLE CATEGORY (%)					
0-15 CATTLE	0	0	0	30	14
16 OR MORE	100	100	100	70	86
DRAUGHT SOURCE (%)					
DONKEY	83	0	0	0	22
CATTLE	17	100	100	70	64
TRACTOR	0	0	0	30	14
CONTROL DRAUGHT (%)					
CONTROL DRAUGHT [b]	100	100	100	70	86
DRAUGHT DEPENDENT [c]	0	0	0	30	14

a. More than one response per trial failure.
b. Owned draught.
c. Hired, cooperative arrangement, or family supplied draught.

TABLE 24: SUMMARY OF RESPONSES, COWPEA VARIETY TRIAL, TOTFG, FRANCISTOWN AREA, 1987-88

FACTOR	SUMMARY OF RESPONSES			
	TVX	ER7	P205C	BLACKEYE
NUMBER OF TRIAL PLANTED	12	17	13	17
TRIALS DOUBLE PLOUGHED	6	11	6	11
TRIALS ROW PLANTED	5	7	7	8
MOST PLANTS (TOTAL SCORE) [a]	42	35	27	19
MOST VIGOUR (TOTAL SCORE) [a]	45	42	33	16
WEED PROBLEMS	3	2	4	4
NUMBER RE-PLANTED	0	0	0	0
NUMBER THINNED	3	4	2	2
NUMBER PLOTS FERTILIZED	0	1	0	1
PROBLEMS (11 FARMERS)				
POOR GERMINATION	1	1	0	0
APHIDS	3	2	1	4
OTHER INSECTS	1	2	2	4
WATER LOGGING	3	0	1	0
WEEDS	0	0	0	1
WHY LIKE VARIETY				
GOOD TASTE AND PALATABILITY	2	3	1	5
MATURE EARLY AND GOOD TASTE	1	1	0	2
MATURE EARLY	1	1	0	0
GOOD MOPOGO	0	1	1	1
GOOD YIELD	0	0	4	2
WHY NOT LIKE VARIETY				
POOR COLOR	1	0	0	1
BAD TASTE	5	1	0	1
SMALL SEED	1	1	0	0
GENERALLY BAD	0	3	0	0
NO LEAVES & SMALL SEED	0	1	0	0
SLOW MATURING	0	0	1	0
LIKED BY INSECTS	0	0	0	2
WANT TO PLANT VARIETY AGAIN	8	10	13	17
OTHER PROBLEMS				
INSECTS	9	8	9	9
WEEDS	0	1	0	1
WATER LOGGING	0	0	1	1
TRY TRIAL AGAIN NEXT YEAR	19 FARMERS			

a. Total no respondents = 19.
b. Weighing scheme: Most = 4; least = 1; summed by variety.

TABLE 25: SUMMARY OF RESPONSES, ROW PLANTING VS BROADCAST TRIAL, TOTFG, FRANCISTOWN AREA, 1987-88

FACTOR	NUMBER OF RESPONSES		
	MASTER	SANITAS	SEBELE
NUMBER RESPONDENTS	1	4	2
USE PLANTER AGAIN			
YES	1	3	1
NO	0	1	1
WHY WOULD USE PLANTER AGAIN			
UNDERSTANDS HOW TO USE IT	0	1	0
EASY TO USE	0	2	0
HAS NECESSARY TRACTION	0	0	1
TAKES LESS TIME COMPARED TO OTHER PLANTERS	1	0	0
WHY WOULD FARMER NOT USE PLANTER AGAIN			
DROPS TOO MUCH SEED	0	1	0
SHORTAGE OF LABOUR	0	0	1
SOIL MOISTURE AT PLANTING FOR TRIAL PLOT			
OPTIMAL	1	2	2
TOO DRY	0	1	0
TOO WET	0	1	0
SOIL MOISTURE AT PLANTING FOR CHECK PLOT			
OPTIMAL	0	3	2
TOO DRY	1	0	0
TOO WET	0	1	0
NUMBER OF PLANTS IN TRIAL PLOT COMPARED TO CHECK PLOT			
TRIAL PLOT GREATER	0	2	2
TRIAL PLOT LESS	3	1	0
SAME	1	0	0
TRIAL PLOT GREW FASTER THAN CHECK PLOT			
TRIAL PLOT FASTER	0	2	2
SAME	1	2	0
RE-PLANTED	0	1	1
RE-PLANTED CHECK PLOT	0	1	1
THINNED	0	3	1
THINNED TRIAL PLOT	0	2	1
THINNED CHECK PLOT	0	1	0
NUMBER OF WEEDS IN TRIAL PLOT COMPARED TO CHECK PLOT			
LESS IN TRIAL PLOT	0	2	0
SAME	1	2	2
THERE WAS NO DIFFERENCE IN KIND OF WEEDS BETWEEN TRIAL AND CHECK	1	4	2
WAS WEEDING LESS WORK FOR TRIAL PLOT			
TRIAL LESS WORK THAN CHECK	0	2	1
SAME	1	2	1

TABLE 25: SUMMARY OF RESPONSES, ROW PLANTING VS BROADCAST TRIAL, TOTFG, FRANCISTOWN AREA, 1987-88 (CONTINUED)

FACTOR	NUMBER OF RESPONSES		
	MASTER	SANITAS	SEBELE
PROBLEMS			
INSECTS	1	3	1
INSECTS AND BIRDS	0	0	1
INSECTS, ANIMALS AND WEEDS	0	1	0
TRY TRIAL AGAIN NEXT YEAR	1	4	2
ADOPT SYSTEM ON LARGER AREA	1	4	2
HOUSEHOLD CHARACTERISTICS			
VILLAGE			
MATHANGWANE	1	4	1
MARAPONG	0	0	1
SEX OF HEAD OF HOUSEHOLD			
MALE	0	0	2
FEMALE	1	4	0
AGE OF HEAD OF HOUSEHOLD			
< 50	1	2	3
50-60	0	2	0
> 60	0	0	2
NUMBER OF CATTLE OWNED			
NO CATTLE	1	1	0
1-15 HEAD	0	3	1
16- 40 HEAD	0	0	1
DRAUGHT TYPE			
CATTLE	0	2	1
TRACTOR	1	2	1
CONTROL DRAUGHT			
CONTROL DRAUGHT	0	0	2
DRAUGHT DEPENDENT	1	4	0

5.2.5.5 Single Super Phosphate vs Unfertilized Trial

Six farmers who participated in the fertilizer trials were interviewed. Their responses to the questionnaire concerning the fertilizer trials are presented in Table 26. All reported that the fertilized plots gave more yield and most thought that there were more plants in the trial plot and that they grew faster. Half thought that there were less weeds in the check plot.

TABLE 26: SUMMARY OF RESPONSES, SINGLE SUPER PHOSPHATE VS UNFERTILIZED TRIAL, TOTFG, FRANCISTOWN AREA, 1987-88 [a]

FACTOR	SUMMARY OF RESPONSES
CROP VARIETIES PLANTED	NOT REPORTED = 2; SORGHUM = 1; MAIZE = 1; MILLET = 1; COWPEAS = 1
WOULD FARMER USE FERTILIZER AGAIN	YES = 6
WHY WOULD USE AGAIN	FERTILIZER GIVES MORE YIELD = 6
PLANTING CONDITIONS	TRIAL PLOT: OPTIMAL = 3; TOO WET = 3 CHECK PLOT: OPTIMAL = 3; TOO WET = 3
NUMBER OF PLANTS IN TRIAL PLOT	GREATER THAN CHECK = 5; SAME AS CHECK = 1
WHICH PLANTS GREW FASTER	TRIAL FASTER = 5; SAME = 1
RE-PLANT	YES = 1; NO = 5 - RE-PLANTED CHECK PLOT ONLY
THIN	YES = 1; NO = 5 - THINNED CHECK PLOT ONLY
DIFFERENCE IN KINDS OF WEEDS BETWEEN PLOTS	NO = 6
WEEDING MORE OR LESS WORK IN TRIAL PLOT	LESS THAN CHECK PLOT = 3; SAME AS CHECK PLOT = 3
OTHER PROBLEMS	INSECTS AND/OR = 4; LATE PLANTING = 1
TRY FERTILIZER AGAIN NEXT YEAR	YES = 6
PLAN TO USE FERTILIZER ON LARGER PART OF FIELD (ADOPT)	YES = 6

a. Number of respondents = 6.

5.2.5.6 Captan Treated Groundnut Seed vs Untreated Groundnut Seed Trial

Interviews were conducted with 40 farmers who participated in this trial. Their responses to the questionnaire covering the trial are contained in Table 27. Seventy-eight percent of the respondents thought the treated seed had the most emergence while 40 percent thought the treated seed emerged first. Half thought the treated and untreated seed emerged at the same time. Seventy-three percent thought the plots with treated seed had more plants and half thought the plants from treated seed grew faster. There was no difference in weeding labour between the plots with treated and untreated seed.

TABLE 27: SUMMARY OF RESPONSES, CAPTAN TREATED GROUNDNUT SEED VS UNTREATED GROUNDNUT SEED TRIAL, TOTFG, FRANCISTOWN AREA, 1987-88

FACTOR	SUMMARY OF RESPONSES
WHICH TYPE OF SEED HAD MOST EMERGENCE	TREATED = 31; UNTREATED = 7; SAME = 1
DID TREATED SEED EMERGE BEFORE UNTREATED	BEFORE = 16; AFTER = 3; SAME = 20
NUMBER OF PLANTS IN TRIAL PLOT	GREATER THAN CHECK = 29; LESS THAN CHECK = 5; SAME AS CHECK = 5
WHICH PLANTS GREW FASTER	TREATED FASTER = 20; TREATED SLOWER = 3; SAME = 16
RE-PLANT WHICH PLOT RE-PLANTED	YES = 2; NO = 37 TRIAL = 1; CHECK PLOT = 1
THIN	NO = 40
DIFFERENCE IN KINDS OF WEEDS BETWEEN PLOTS	YES = 5; NO = 33
WEEDING MORE OR LESS WORK IN TRIAL PLOT	LESS THAN CHECK PLOT = 2; SAME AS CHECK PLOT = 38
SAME KIND OF WEEDS IN PLOT LAST YEAR	YES = 13; NO = 7
OTHER PROBLEMS	INSECTS = 6; BIRDS = 4; WATERLOG = 4; LATE PLANTING = 1; WILD ANIMALS = 3; IMPLEMENTATION PROBLEMS = 1
TRY TRIAL AGAIN NEXT YEAR	YES = 40
PLAN TO USE TREATMENT ON LARGER PART OF FIELD (ADOPT)	YES = 39; NO = 1

a. Number of respondents = 40

5.2.6 Summary of End-of-Season Survey

The End-of-Season Survey was administered to 119 of the 143 farmer group members. Members generally participated in the group meetings and found them helpful for discussing problems with ATIP staff and extension, sharing experiences with other farmers, and acquiring new ideas.

The trial chosen most often was double ploughing versus single ploughing, followed by groundnut trials. Cowpeas were the most popular seed type for double ploughing, and row planting trials. This may well be because cowpeas are considered a high value crop and seed was scarce during the drought years. The primary reason for choosing a trial was "to see if it would work" and "greater yield" was the major benefit reported. Trial failures ran from 0 percent for fertilizer trials to 69 percent for long and short season variety trials. The trials generally failed before ploughing (due to lack of traction) or before harvesting (after weeding). These failures were due mostly to late planting/poor germination and implementation problems.

During this season the double ploughing versus single ploughing technology appealed to traditional farmers who used cattle for traction. This reflects the fact that the technology required additional traction resources and possibly that it was not a major change from the traditional system, hence did not require much increased management skill. Long and short season crop mixture trials seemed to appeal to the more innovative farmers with greater resources, i.e., younger farmers from a "progressive" village who owned more cattle. This group also showed more interest in the cowpea variety trials, probably because cowpeas were considered a high value crop, and these farmers had access to additional resources to invest in a higher level of management for the more valuable crop or maybe they were more cash-crop oriented.

The row planting technology appealed to limited resource households, which tended to be female-headed, and to those using hired tractors. The use of hand row planters allowed these farmers to separate the ploughing and the planting operations. These farmers also tended to be in communities where there were labour shortages, another factor influencing the hiring of tractors.

This season, fertilizer was used mostly by more limited resource farmers, probably those who had labour constraints. This may be because it is a technology which does not require a major investment of labour or additional draught power, nor does it require a major increase in management skills. Also, the timing of implementation is not critical.

Even though it was most popular in the "progressive" village, the groundnut seed treatments trial had broad general appeal to farmers. This is probably because it was easy to implement (requiring no additional tillage operations) and produced a high value product, one for which seeds were often in short supply.

Generally farmers indicated they were pleased with the trials, even though there were failures, and that they wished to conduct similar trials in the following year. There was also an indication of interest in using the technologies on plots other than trial plots.

APPENDIX A1: DOUBLE PLOUGHING TRIALS, TOTFG, FRANCISTOWN AREA, 1987-88[a]

VILLAGE	FARMER	CROP	TRACT	PLANTING DATE	BROADCAST ROW PLANT	DP POP	TC POP	DP YIELD	TC YIELD
						— X 1000 —		KG PER HECTARE	
61	25	4	2	141	2	12.8	7.2	256	144
61	28	2	2	147	2	21.4	12.9	428	258
61	30	2	2	168	2	4.5	2.0	90	40
61	23	8	2	147	2	7.5	3.3	150	66
61	24	2	2	169	2	3.2	1.9	64	38
61	25	1	2	141	2	50.0	16.0	1000	320
61	1	1	2	140	2	22.0	15.2	440	304
61	1	3	2	140	1	3.5	1.5	70	30
61	4	3	2	149	2	3.4	2.2	68	44
61	33	2	2	149	2	23.5	17.5	470	350
61	51	1	2	143	2	7.5	4.3	150	86
61	51	3	2	143	2	3.5	2.5	7[illegible]	50
61	7	4	2	141	2	3.9	0.7	78	14
61	7	1	2	141	2	49.5	49.5	990	990
61	7	2	2	141	2	10.5	6.5	210	130
61	11	2	2	126	2	55.0	50.5	1100	1010
61	11	1	2	119	1	92.5	49.0	1850	980
61	8	1	2	135	1	20.0	20.0	400	400
61	17	1	2	140	2	15.5	0.0	310	0
61	21	4	2	169	2	3.6	3.9	72	78
61	23	2	2	147	2	11.5	4.3	230	86
61	3	2	2	135	2	1.3	0.7	26	14
61	3	3	2	135	2	1.6	1.0	32	20
61	12	1	2	173	1	10.9	8.0	218	160
61	4	2	2	149	2	7.0	3.0	140	60
61	29	2	2	121	2	59.5	31.2	1190	624
61	[illegible]	3	2	168	2	8.3	6.5	166	130
61	[illegible]	3	3	149	2	23.0	20.3	460	[illegible]
61	[illegible]	3	2	147	2	25.1	15.4	502	[illegible]
61	29	3	2	121	1	3.8	0.9	76	18
[illegible]	29	1	2	121	2	58.2	22.2	1164	444
61	34	3	2	121	1	5.0	5.7	100	114
61	40	6	2	140	1	26.0	25.0	520	500
61	47	3	3	121	1	5.7	2.3	114	46
61	33	4	2	149	2	11.8	6.9	236	138
61	34	1	2	121	2	21.5	16.6	430	332
61	34	2	2	121	2	32.3	31.4	646	628
61	6	4	2	147	2	1.9	0.0	38	0
61	8	3	1	135	1	11.5	19.7	230	394
61	10	1	2	148	2	6.0	2.2	120	44
61	5	3	2	147	2	1.4	0.6	28	12
61	5	1	2	147	2	8.6	1.0	172	20
61	6	2	2	147	2	4.5	0.0	90	0
61	18	3	2	136	2	11.5	4.4	230	88
61	27	2	2	136	2	45.2	17.0	904	340
61	27	3	2	136	1	9.5	5.5	190	110
61	11	3	2	126	2	9.8	8.7	196	174
61	17	4	2	140	2	8.5	1.5	170	30

a. Codes at end of table.

APPENDIX A1: DOUBLE PLOUGHING TRIALS, TOTFG, FRANCISTOWN AREA, 1987-88 (CONTINUED)

VILLAGE	FARMER	CROP	TRACT	PLANTING DATE	BROADCAST ROW PLANT	DP POP	TC POP	DP YIELD	TC YIELD
						-- X 1000 --		KG PER HECTARE	
61	18	2	2	136	2	25.4	10.5	508	210
62	24	3	2	134	2	8.3	8.2	166	164
62	4	4	3	103	2	11.2	11.3	224	226
62	32	3	3	166	2	2.0	1.5	40	30
62	28	4	2	103	2	18.5	12.5	370	250
63	24	3	2	127	2	2.5	1.9	50	38
63	29	2	2	133	2	11.2	4.8	224	96
63	8	5	1	133	1	37.0	29.5	740	590
63	3	3	2	126	2	5.0	2.0	100	40
63	1	2	2	146	2	9.8	2.7	196	54
63	27	2	2	131	1	5.6	5.5	112	110
63	8	7	1	133	1	7.9	7.5	158	150
63	3	2	1	126	2	53.0	26.0	1060	520
63	3	5	2	126	2	10.0	3.5	200	70

VILLAGE: 61 = Matobo; 62 = Mathangwane; 63 = Marapong.
CROP: 1 = Sorghum (v. Segsolane); 2 = Millet (v. Serere 6A); 3,4,5 = Cowpeas (v. Blackeye, Em7, B005C, respectively); 6 = Maize (v. Kalahari Earl Pearl).
TRACTION: 1 = Tractor; 2 = Cattle; 3 = Donkey.
PLANT DATE: Numbered days from September 1, 1987.
BROADCAST/ROW PLANT: 1 = Row Plant; 2 = Broadcast.
POP: Plant Stand Density per hectare.

APPENDIX A2: GROUNDNUT SEED TREATMENT TRIAL, TOTFG, FRANCISTOWN AREA, 1987-88

VILLAGE	FARMER	TRACTION	PLANT DATE	TREATMENT POP	TC POP	TREATMENT YIELD	TC YIELD	DP	RP
				-- X 1000 --		KG PER HECTARE			
61	55	2	135	5.0	2.1	200	84	1	2
61	47	3	121	0.5	1.0	20	40	2	1
61	40	2	126	6.0	5.7	240	[illegible]	2	2
61	31	3	149	7.0	4.4	280	176	1	2
61	30	2	168	2.4	[illegible]	96	[illegible]	1	2
61	29	2	121	9.8	5.2	392	208	2	2
61	28	2	147	0.7	1.1	26	44	1	2
61	24	2	135	1.9	0.9	76	36	2	2
61	23	2	148	2.8	1.2	112	48	2	2
61	11	2	126	3.3	2.8	132	112	2	2
62	46	1	108	13.4	11.3	536	452	2	2
62	42	1	127	2.2	1.5	88	60	2	2
62	36	1	99	13.4	5.7	536	228	2	2
62	34	2	119	7.5	4.8	300	192	2	2
62	31	3	101	8.6	6.9	344	276	2	2
62	24	2	126	7.0	2.0	280	80	2	2
62	22	1	117	15.4	10.5	616	420	2	2
62	14	1	107	14.0	19.6	560	784	2	2
62	13	1	129	1.6	1.4	64	56	2	2
62	12	1	127	4.1	4.3	164	172	2	2
62	8	[illegible]	102	10.7	8.3	428	332	2	2
62	7	1	137	4.3	4.0	172	160	1	1
62	5	1	113	12.0	8.2	480	328	2	2
62	4	1	103	28.3	12.8	1132	512	2	2
63	38	2	122	5.8	4.0	232	160	1	2
63	36	2	129	5.0	[illegible]	200	128	2	2
63	34	2	134	1.7	1.6	68	64	1	2
63	29	2	133	2.2	[illegible]	48	132	1	2
63	27	2	131	3.0	[illegible]	120	0	1	2
63	19	1	95	23.0	22.0	920	880	1	2
63	18	2	109	5.9	8.2	236	328	1	2
63	17	2	108	4.0	[illegible]	160	516	1	2
63	16	2	130	15.0	14.5	600	580	2	2
63	16	2	130	4.0	3.0	160	120	2	1
63	15	2	153	3.6	4.4	144	176	1	2
63	14	2	98	20.0	15.8	800	632	2	2
63	11	2	92	7.0	5.6	280	224	2	2
63	10	1	100	26.0	17.0	1040	680	1	2
63	9	2	113	27.0	22.0	1080	880	2	2
63	4	2	124	4.5	1.6	180	64	1	2
63	13	2	120	3.5	7.3	140	292	2	2
63	2	2	124	8.3	3.7	332	148	1	2
63	3	1	126	21.9	15.8	876	632	2	2
61	34	2	124	3.4	7.0	136	280	2	2

VILLAGE: 61 = Matobo; 62 = Mathangwane; 63 = Marapong.
TRACTION: 1 = Tractor; 2 = Cattle; 3 = Donkey.
PLANTING DATE: Numbered days from September 1, 1987.
DP (Double Ploughed): 1 = Yes; 2 = No.
RP (Row Planted): 1 = Yes; 2 = No.
POP: Stand Density in Plants per Hectare.

APPENDIX A3: ROW PLANTED VERSUS BROADCAST PLANTED TRIALS, TOTFG, FRANCISTOWN AREA, 1987-88

VILLAGE	FARMER	PLANT DATE RP	PLANT DATE BC	TRACT	PLANTER TYPE	CROP	RP POP	BC POP	RP YIELD	BC YIELD
							-- x 1000 --		KG PER HECTARE	
63	34	134	134	2	4	2	1.5	2.1	30	42
62	2	136	124	1	1	3	1.9	11.7	38	234
62	3	103	103	1	2	4	4.6	3.8	92	76
62	4	136	136	1	2	2	4.5	3.2	90	64
62	7	138	137	1	3	4	20.5	10.8	416	216
62	8	115	101	1	2	3	9.3	8.9	186	178
62	14	109	109	1	1	3	10.9	8.0	218	160
62	31	101	101	3	3	4	7.7	7.7	154	154
62	33	128	128	1	2	4	10.0	7.1	200	142
62	46	122	122	1	2	4	15.5	2.0	310	40

VILLAGE: 61 = Matobo; 62 = Mathangwane; 63 = Marapong.
PLANTING DATE: Numbered days from September 1; 1987.
TRACTION: 1 = Tractor; 2 = Cattle; 3 = Donkey.
PLANTER TYPE: 1 = Master Planter; 2 = Sanitas Hand Row Planter; 3 = Sabele Row Planter; 4 = Hand Hoe.
CROP: 1 = Sorghum (v. Segaolane); 2 = Millet (v. Serere 8A); 3 = Cowpeas (v. Blackeye); 4 = Cowpeas (v. ER7).
POP: Stand Density in Plants per Hectare.

APPENDIX A4: COWPEA VARIETY TRIALS, TOTFG, FRANCISTOWN AREA, 1987-88

VIL	FARM	TRACT	PLANT DATE	DP/SP	RP/BC	B/E POP	TVX POP	ER7 POP	BOOSC POP	B/E RANK	TVX RANK	ER7 RANK	BOOSC RANK	B/E YIELD	TVX YIELD	ER7 YIELD	BOOSC YIELD
						------- x 1000 -------								--KILOGRAMS PER HECTARE--			
61	58	2	155	2	2	0.0	0.0	3.5	0.0	2	4	1	3	0	0	70	0
61	56	2	138	2	2	6.8	3.2	7.5	9.[illegible]	2	4	3	1	136	64	150	186
61	55	2	135	1	2	8.6	5.8	6.4	10.4	1	4	3	2	176	116	128	208
61	35	2	127	1	2	9.6	12.8	5.9	17.8	1	4	2	3	192	256	118	356
61	26	2	147	2	1	0.0	0.0	1.5	4.1	1	4	3	2	0	0	30	82
62	45	1	128	2	2	5.0	8.8	5.4	7.4	4	1	2	3	100	176	108	148
62	42	1	127	2	2	1.5	6.2	5.3	0.0	4	2	1	3	30	124	106	0
62	6	1	124	2	2	2.7	18.8	8.0	17.5	3	2	4	1	54	376	160	350
63	38	2	113	2	2	7.9	NA	7.4	NA	1	NA	2	NA	158	NA	148	NA
63	34	2	134	1	1	2.5	6.3	NA	NA	2	1	NA	NA	50	126	NA	NA
63	23	2	133	1	2	NA	NA	11.7	20.0	NA	NA	2	1	NA	NA	234	400
63	27	1	138	1	1	4.9	NA	5.7	NA	2	NA	1	NA	98	NA	114	NA
63	17	2	129	1	1	15.0	4.9	10.2	34.2	2	3	4	1	300	98	204	684
63	16	2	139	2	2	12.2	NA	10.0	NA	1	NA	2	NA	244	NA	200	NA
63	14	2	119	2	1	22.8	38.0	14.5	27.0	1	2	4	3	456	760	290	540
63	11	2	92	2	1	13.0	10.0	6.5	22.0	1	3	4	2	260	200	130	440
63	10	1	137	1		[illegible]	NA	5.3	NA	1	NA	2	NA	134	NA	106	NA
63	9	2	113	2	2	24.4	23.0	9.5	37.4	3	2	4	1	488	460	190	748
63	7	2	157	1	2	0.0	NA	NA	6.9	2	NA	NA	1	0	NA	NA	138
63	13	2	122	2	1	1.8	5.1	10.6	20.0	NA	NA	2	1	36	102	212	400
63	2	2	126	1	1	10.1	NA	4.2	NA	1	NA	2	NA	202	NA	84	NA

VILLAGE: 61 = Matobo; 62 = Mathangwane; 63 = Marapong.
TRACTION: 1 = Tractor; 2 = Cattle; 3 = Donkey.
PLANTING DATE: Numbered days from September 1, 1987.
DP/SP: 1 = Double Ploughed; 2 = Single Ploughed.
RP/BC: 1 = Row Planted; 2 = Broadcasted.
POP: Plant Stand Density per Hectare.
RANK: Farmers Ranking among Varieties, 1 = Best; 4 = Worst.
NOTE: Zeros in both the population and yield columns indicate that the variety was not planted.

APPENDIX A5: PHOSPHATE FERTILIZER TRIALS, TOTFG, FRANCISTOWN AREA, 1987-88

VILLAGE	FARMER	TRACT	PLANT DATE	CROP	FERT POP	TC POP	FERT YIELD	TC YIELD
					-- X 1000 --		KG PER HECTARE	
61	53	2	166	3	3.5	1.0	75	20
61	53	2	166	1	11.3	8.5	226	178
62	8	1	101	1	55.3	32.4	1106	648
62	14	1	105	1	14.1	5.8	282	116
62	16	1	115	1	33.7	17.1	674	342
62	17	1	114	3	10.8	8.8	216	176
62	31	3	124	2	37.9	34.1	758	682
63	14	2	101	4	53.0	38.0	1060	760

VILLAGE: 61 = Matobo; 62 = Mathangwane; 63 = Marapong.
TRACTION: 1 = Tractor; 2 = Cattle; 3 = Donkey.
PLANTING DATE: Numbered days from September 1, 1987.
CROP: 1 = Sorghum (v. Segaolane), 2 = Millet (v. Serere 6A),
3 = Cowpea (v. Blackeye), 4 = Maize (v. Kalahari Early Pearl).
POP: Stand Density in Plants per Hectare.

APPENDIX A6: LONG AND SHORT SEASON CROP MIXES TRIALS, TOTFG, FRANCISTOWN AREA, 1987-88

VILLAGE	FARMER	TRACT	PLANT DATE	DP/SP	RP/BC	SEGAOLANE POP	650 POP	TOWN POP	SEGAOLANE YIELD	650 YIELD	TOWN YIELD
						------ X 1000 -------			---- KG PER HECTARE ----		
63	24	2	143	1	1	1.2	1.0	NA	24	20	NA
63	10	1	138	1	1	16.5	12.2	15.5	370	244	310
63	2	2	126	1	1	18.2	7.2	NA	364	144	NA
63	1	2	146	1	2	6.0	3.5	NA	120	70	NA
62	34	2	119	2	2	13.9	9.0	13.9	278	180	278
62	31	3	133	2	2	15.9	13.0	3.6	318	260	72
62	20	1	120	2	2	13.4	8.5	8.5	268	170	170

VILLAGE: 61 = Matobo; 62 = Mathangwane; 63 = Marapong.
TRACTION: 1 = Tractor, 2 = Cattle, 3 = Donkey.
PLANTING DATE: Numbered days from September 1, 1987.
DP/SP: 1 = Double Plough, 2 - Single Plough.
RP/BC: 1 = Row Plant 2 = Broadcast.
POP: Plant Stand Density per Hectare.

APPENDIX B1
ATIP FRANCISTOWN
1988 END-OF-SEASON TRIALS ASSESSMENT SURVEY
FOR THE FARMER OPTION TESTING GROUPS

FARMER NAME: _____

FARMER NUMBER: _____ DVDU: _____

VILLAGE: _____ DATE: _____

1. IN WHICH TRIAL OR TRIALS DID YOU PARTICIPATE? TRIAL: _____

   1 - DOUBLE PLOUGHING VS. SINGLE PLOUGHING ----- [ ]
   2 - LONG/SHORT SEASON STABILITY TRIALS ---------- [ ]
   3 - COWPEA VARIETY TRIALS ---------- [ ]
   4 - ROW PLANTING VS. TRADITIONAL BROADCASTING - [ ]
   5 - MASTER VS. SANITAS PLANTER ---------- [ ]
   6 - SINGLE SUPER PHOSPHATE VS. UNFERTILIZED --- [ ]
   7 - CAPTAN TREATED GROUNDNUT SEED VS. ---------- [ ]
   UNTREATED GROUNDNUT SEED

   [ENUMERATORS: PLEASE MAKE SURE A SEPARATE QUESTIONNAIRE IS ATTACHED FOR EACH BOX CHECKED].

2. HAVE YOU PARTICIPATED IN THE FARMER GROUP MEETINGS?

   YES(1) [ ] OR NO(2) [ ] PARTMEET: _____

3. IF YES, DID YOU FIND THE MEETINGS HELPFUL?

   YES(1) [ ] OR NO(2) [ ] HELPFUL: _____

   A. IF YES, HOW WERE THE MEETINGS HELPFUL? HOWHELP: _____ (POSTCODE)

   _____

   _____

   B. IF NO, WHY WERE THEY NOT HELPFUL? NOTHELP: _____ (POSTCODE)

   _____

   _____

4. DO YOU WISH TO PARTICIPATE IN THE FARMER GROUP NEXT YEAR?

   YES(1) [ ] OR NO(2) [ ] NEXTYEAR: _____

GENERAL QUESTIONS FOR EACH TRIAL

1. WHY DID YOU CHOOSE THIS TRIAL? DVDU:_____

_____

_____ CHOOSE:_____ (POSTCODE)

2A. WAS THE TRIAL IMPLEMENTED AS PLANNED? PLANNED:_____

YES(1) ☐ OR NO(2) ☐

2B. IF NO, WHAT PROBLEMS OCCURRED?

_____

_____

3. DID THE TRIAL FAIL? FAIL:_____

YES(1) ☐ OR NO(2) ☐

A. IF YES, WHEN? WHENFAIL:_____

1-BEFORE PLOUGHING ☐
2-BEFORE PLANTING ☐
3-BEFORE WEEDING ☐
4-BEFORE HARVESTING ☐

B. WHY? WHYFAIL:_____ (POSTCODE)

_____

_____

4A. DID YOU FIND ANY BENEFITS FROM THIS TRIAL? BENEFITS:_____

YES(1) ☐ OR NO(2) ☐

4B. IF YES, WHAT? WHATBENE:_____

_____

_____

5. WHAT TRACTION SOURCE DID YOU USE FOR THE ATIP TRIALS? TRAC:_____ SOURCE:_____

	OWN	HIRE	COOP/BORR
DONKEY			
CATTLE			
TRACTOR			

[CODING FOR TRAC:
1=DONKEY, 2=CATTLE
3=TRACTOR, 4=DONK/CATT
5=DONK/TRAC, 6=CATT/TRAC
CODING FOR SOURCE:
1=OWN, 2=HIRE, 3=COOP/BORR
4=OWN/HIRE, 5=OWN/COOP/BORR
6=HIRE/COOP/BORR]

6A. WERE THERE ANY PROBLEMS WITH YOUR TRACTION SOURCE CONCERNING THE ATIP TRIALS? PROBTRAC:_____

YES(1) ☐ OR NO(2) ☐

6B. IF YES, PLEASE EXPLAIN: EXPRBTRC:_____ (POSTCODE)

_____

_____

7. [FOR ENUMERATORS TO DO — DRAW A MAP OF PLOT AND INDICATE TRIALS]

1. DOUBLE PLOUGHING VS. SINGLE PLOUGHING

DVDU:_____

1. DID IT TAKE LESS TIME TO PLOUGH THE SECOND TIME? LESSTIME:_____

YES(1) ☐ OR NO(2) ☐

2. FOR EACH PLOUGHING, WHAT WAS THE SOIL MOISTURE CONDITION OF THE PLOT COMPARED TO THE TRADITIONAL PLOT? 1STMOIS:_____ 2NDMOIS:_____

TRIAL PLOT 1ST PLOUGH	TRIAL PLOT 2ND PLOUGH		TRADITIONAL CHECK PLOT
_____	_____	OPTIMAL MOISTURE(1)	_____
_____	_____	TOO DRY TO PLANT(2)	_____
_____	_____	TOO WET TO PLANT(3)	_____

TRDMOIS:_____

3A. IN YOUR OPINION, WHICH PLOT HAD A GREATER YIELD, THE TRADITIONALLY SINGLE PLOUGHED PLOT OR THE DOUBLE PLOUGHED PLOT? GRTRYLD:_____

DOUBLE(1) PLOUGHED ☐ SINGLE(2) PLOUGHED ☐ SAME(3) YIELD ☐

3B. IF THE DOUBLE PLOUGHED PLOTS WERE MORE WORK THAN THE TRADITIONAL SINGLE PLOUGHED CHECK PLOT, DO YOU CONSIDER THE EXTRA HARVEST WORTH THE EXTRA EFFORT IT TOOK TO DOUBLE PLOUGH YOUR TRIAL?

YES(1) ☐ OR NO(2) ☐ EFFORT:_____

4A. DID YOU ROW PLANT? ROWPLNT:_____

YES(1) ☐ OR NO(2) ☐

4B. IF YES, HOW WERE CONDITIONS WHEN YOU PLANTED? TRLPLANT:_____ CHECKPLT:_____

TRIAL PLOT		CHECK PLOT
_____	OPTIMAL MOISTURE(1)	_____
_____	TOO DRY TO PLANT(2)	_____
_____	TOO WET TO PLANT(3)	_____

5. WAS THE NUMBER OF PLANTS IN THE TRIAL PLOT GREATER OR LESS THAN IN THE TRADITIONALLY PLOUGHED PLOT? PLNTNBR:_____

GREATER(1) ☐ LESS(2) ☐ OR THE SAME(3) ☐

6. DID THE PLANTS GROW FASTER OR SLOWER IN THE TRIAL PLOT THAN IN THE TRADITIONAL PLOT? GROWFAST:_____

FASTER(1) ☐ SLOWER(2) ☐ OR THE SAME(3) ☐

7A. DID YOU RE-PLANT ANY OF THE PLOT AREAS? RE-PLANT:_____

YES(1) ☐ OR NO(2) ☐

7B. IF YES, WHICH PLOT WAS RE-PLANTED? WHICHRPL:_____

TRIAL(1) ☐ TRADITIONAL(2) ☐ OR BOTH(3) ☐

8A. DID YOU THIN ANY OF THE PLOT AREAS? THIN:_____

YES(1) ☐ OR NO(2) ☐

8B. IF YES, WHICH PLOT WAS THINNED? WHCHTHIN:_____

TRIAL(1) ☐ TRADITIONAL(2) ☐ OR BOTH(3) ☐

9. DID YOU SEE ANY DIFFERENCE IN THE KINDS OF WEEDS? KINDWEED:_____

YES(1) ☐ OR NO(2) ☐

10A. DO YOU THINK WEEDING WAS MORE OR LESS WORK FOR THE TRIAL PLOT THAN FOR THE TRADITIONAL PLOT? WEEDWORK:_____

MORE THAN(1) TRADITIONAL ☐ LESS THAN(2) TRADITIONAL ☐ OR THE SAME(3) ☐

10B. WERE THERE ANY PARTICULAR PROBLEM WEEDS? PROBWEED:_____ (POSTCODE)

_____

10C. WERE THESE WEEDS IN THE FIELD LAST YEAR? LASTYRPB:_____

YES(1) ☐ OR NO(2) ☐

11. WERE THERE ANY OTHER PROBLEMS WITH THIS TRIAL? (INCLUDE INSECTS AND BIRDS HERE) PROBLEMS:_____ (POSTCODE)

_____

_____

_____

_____

12. WOULD YOU LIKE TO TRY THIS SYSTEM AGAIN NEXT YEAR? TRYAGAIN:_____

YES(1) [ ] OR NO(2) [ ]

13. ARE YOU PLANNING TO USE THIS SYSTEM ON A LARGER PART OF YOUR FIELD NEXT YEAR? ADOPTION:_____

YES(1) [ ] OR NO(2) [ ]

2. LONG AND SHORT SEASON STABILITY TRIALS

DVDU:_____

1. LIST THE CROPS AND VARIETIES PLANTED:

CROP:	VARIETY:	
1)._____	_____	CROP1:_____
2)._____	_____	CROP2:_____
3)._____	_____	CROP3:_____
4)._____	_____	CROP4:_____
5)._____	_____	CROP5:_____

2. WAS THE TRIAL PLANTED EARLY, LATE, OR MID-SEASON? WHENPLNT:_____

EARLY(1) [ ] LATE(2) [ ] OR MID-SEASON(3) [ ]

3A. DID ALL THE CROPS MATURE? MATURE:_____

YES(1) [ ] OR NO(2) [ ]

3B. IF NO, WHICH CROPS FAILED AND WHY?

CROP:	REASON FAILED:	
1)._____	_____	FAIL1:_____
2)._____	_____	FAIL2:_____
3)._____	_____	FAIL3:_____
4)._____	_____	FAIL4:_____
5)._____	_____	FAIL5:_____

4. DID ANY OF THE CROPS RIPEN TOO EARLY AND GET DAMAGED BY THE RAIN? RIPEN:_____

YES(1) [ ] OR NO(2) [ ]

5. DO YOU FEEL THAT PLANTING CROPS OF DIFFERENT MATURITY LENGTHS CAN HELP REDUCE THE RISK OF COMPLETE CROP FAILURE? MATURITY:_____

YES(1) [ ] OR NO(2) [ ]

6. DO YOU FEEL THAT PLANTING CROPS OF DIFFERENT MATURITY LENGTHS IS A GOOD IDEA? GOODIDEA:_____

YES(1) ☐ OR NO(2) ☐

7A. DID YOU RE-PLANT ANY OF THE PLOT AREAS? RE-PLANT:_____

YES(1) ☐ OR NO(2) ☐

7B. IF YES, WHICH CROP/VARIETY WAS RE-PLANTED? WHICHRPL:_____

_____

_____

8A. DID YOU THIN ANY OF THE PLOT AREAS? THIN:_____

YES(1) ☐ OR NO(2) ☐

8B. IF YES, WHICH CROP/VARIETY WAS THINNED? WHCHTHIN:_____

_____

_____

9. DID YOU SEE ANY DIFFERENCE IN THE KINDS OF WEEDS? KINDWEED:_____

YES(1) ☐ OR NO(2) ☐

10A. WERE THERE ANY PARTICULAR PROBLEM WEEDS? PROBWEED:_____ (POSTCODE)

_____

10B. WERE THESE IN THE FIELD LAST YEAR? LASTYRPB:_____

YES(1) ☐ OR NO(2) ☐

11. WERE THERE ANY OTHER PROBLEMS WITH THIS TRIAL? (INCLUDE INSECTS AND BIRDS HERE) PROBLEMS:_____ (POSTCODE)

_____

_____

_____

_____

12. WOULD YOU LIKE TO TRY THIS SYSTEM AGAIN NEXT YEAR? TRYAGAIN:_____

YES(1) ☐ OR NO(2) ☐

13. ARE YOU PLANNING TO USE THIS SYSTEM ON A LARGER PART OF YOUR FIELD NEXT YEAR? ADOPTION:_____

YES(1) ☐ OR NO(2) ☐

3. COWPEA VARIETY TRIALS

DVDU:_____

1. LIST EACH VARIETY YOU PLANTED. NEXT TO EACH VARIETY LIST THE PLOUGHING METHOD (DOUBLE PLOUGH=1, SINGLE PLOUGH=2), AND THE PLANTING METHOD (ROW PLANT=1, BROADCAST=2).

VARIETY:	PLOUGHING METHOD:	PLANTING METHOD:		
1)._____	_____	_____	PLOW1:_____	PLNT1:_____
2)._____	_____	_____	PLOW2:_____	PLNT2:_____
3)._____	_____	_____	PLOW3:_____	PLNT3:_____
4)._____	_____	_____	PLOW4:_____	PLNT4:_____

2. RANK THE VARIETIES FROM 1 TO 5 ACCORDING TO WHICH HAD THE MOST PLANTS, 1=MOST PLANTS, 5=LEAST PLANTS. ALSO RANK THE VARIETIES ACCORDING TO WHICH HAD THE MOST VIGOUR.

[VIGOUR MEANS THOSE PLANTS WHICH WERE LARGER AND GREW FASTER EARLY IN THE SEASON].

VARIETY:	MOST PLANTS:	MOST VIGOUR:		
1)._____	_____	_____	MOPL1:_____	MOVG1:_____
2)._____	_____	_____	MOPL2:_____	MOVG2:_____
3)._____	_____	_____	MOPL3:_____	MOVG3:_____
4)._____	_____	_____	MOPL4:_____	MOVG4:_____

3. INDICATE YES OR NO NEXT TO EACH VARIETY WHETHER YOU HAD A WEED PROBLEM, RE-PLANTING WAS NECESSARY, THINNING WAS NECESSARY, OR YOU APPLIED FERTILIZER.

VARIETY:	WEED PROB:	RE-PLNT:	THIN-NED:	FERT-LIZER.
1)._____	____	____	____	____
2)._____	____	____	____	____
3)._____	____	____	____	____
4)._____	____	____	____	____

CODING:

WEED1:_____	REPT1:_____	THIN1:_____	FERT1:_____
WEED2:_____	REPT2:_____	THIN2:_____	FERT2:_____
WEED3:_____	REPT3:_____	THIN3:_____	FERT3:_____
WEED4:_____	REPT4:_____	THIN4:_____	FERT4:_____

4A. DID YOU HAVE PROBLEMS WITH ANY VARIETY? VARPROB:_____

YES(1) [ ] OR NO(2) [ ]

4B. IF YES, LIST THE VARIETIES AND THE PROBLEMS.

VARIETY:	PROBLEMS:	
1)._____	_____	PROB1:_____
2)._____	_____	PROB2:_____
3)._____	_____	PROB3:_____
4)._____	_____	PROB4:_____

5. WHICH VARIETIES DID YOU LIKE THE MOST AND WHY?

_____

_____

_____

6. WHICH VARIETIES DID YOU LIKE THE LEAST AND WHY?

_____

_____

_____

7. WHICH VARIETIES WOULD YOU LIKE TO PLANT AGAIN NEXT YEAR?

_____

_____

_____

8. WERE THERE ANY OTHER PROBLEMS WITH THE TRIALS? (INCLUDE INSECTS AND BIRDS HERE)

_____

_____

_____

_____

9. WOULD YOU LIKE TO DO A SIMILAR TRIAL NEXT YEAR? TRYAGAIN:_____

YES(1) [ ] OR NO(2) [ ]

4. ROW PLANTING VS. TRADITIONAL BROADCASTING

DVDU:_____

1. WHAT ROW PLANTER DID YOU USE? PLANTER:_____

MASTER(1) ☐ SANITAS(2) ☐ SEBELE(3) ☐

SAFIM (4) ☐ OTHER: _____

2A. WOULD YOU USE IT AGAIN? USEAGAIN:_____

YES(1) ☐ OR NO(2) ☐

2B. IF YES, WHY?_____ WHYUSE:_____

_____

2C. IF NO, WHY NOT?_____ WHYNOT:_____

_____

3. HOW WERE SOIL MOISTURE CONDITIONS WHEN YOU PLANTED? SOILMOIS:_____

TRIAL PLOT		CHECK PLOT
_____	OPTIMAL MOISTURE	_____
_____	TOO DRY TO PLANT	_____
_____	TOO WET TO PLANT	_____

4. WAS THE NUMBER OF PLANTS IN THE TRIAL PLOT GREATER OR LESS THAN THE TRADITIONALLY PLANTED PLOT? PLNTNBR:_____

GREATER(1) ☐ LESS(2) ☐ OR THE SAME(3) ☐

5. DID THE PLANTS GROW FASTER OR SLOWER IN THE TRIAL PLOT THAN IN THE TRADITIONAL PLOT? GROWFAST:_____

FASTER(1) ☐ SLOWER(2) ☐ OR THE SAME(3) ☐

6A. DID YOU RE-PLANT ANY OF THE PLOT AREAS? RE-PLANT:_____

YES(1) ☐ OR NO(2) ☐

6B. IF YES, WHICH PLOT WAS RE-PLANTED? WHICHRPL:_____

TRIAL(1) ☐ TRADITIONAL(2) ☐ OR BOTH(3) ☐

7A. DID YOU THIN ANY OF THE PLOT AREAS? THIN:_____

YES(1) ☐ OR NO(2) ☐

7B. IF YES, WHICH PLOT WAS THINNED? WHCHTHIN:_____

TRIAL(1) ☐ TRADITIONAL(2) ☐ OR BOTH(3) ☐

8. WERE THERE MORE OR LESS WEEDS IN THE TRIAL PLOT THAN IN THE TRADITIONAL PLOT? WEEDNBR:_____

MORE THAN(1) TRADITIONAL ☐ LESS THAN(2) TRADITIONAL ☐ OR THE SAME(3) ☐

9. DID YOU SEE ANY DIFFERENCE IN THE KINDS OF WEEDS? KINDWEED:_____

YES(1) ☐ OR NO(2) ☐

10A. DO YOU THINK WEEDING WAS MORE OR LESS WORK FOR THE TRIAL PLOT THAN FOR THE TRADITIONAL PLOT? WEEDWORK:_____

MORE THAN(1) TRADITIONAL ☐ LESS THAN(2) TRADITIONAL ☐ OR THE SAME(3) ☐

10B. WERE THERE ANY PARTICULAR PROBLEM WEEDS? PROBWEED:_____ (POSTCODE)

_____

10C. WERE THESE IN THE FIELD LAST YEAR? LASTYRPB:_____

YES(1) ☐ OR NO(2) ☐

11. WERE THERE ANY OTHER PROBLEMS WITH THIS TRIAL? (INCLUDE INSECTS AND BIRDS HERE) PROBLEMS:_____ (POSTCODE)

_____

_____

_____

_____

12. WOULD YOU LIKE TO TRY THIS SYSTEM AGAIN NEXT YEAR? TRYAGAIN:_____

YES(1) ☐ OR NO(2) ☐

13. ARE YOU PLANNING TO USE THIS SYSTEM ON A LARGER PART YOUR FIELD NEXT YEAR? ADOPTION:_____

YES(1) ☐ OR NO(2) ☐

5. MASTER VS. SANITAS PLANTER

DVDU:_____

1A. WHICH ROW PLANTER DID YOU PREFER? ROWPREF:_____

MASTER(1) [ ] SANITAS(2) [ ] OR EQUAL(3) [ ]

1B. WHY?_____ WHYPREF:_____ (POSTCODE)

_____

2. WHICH PLANTER WAS EASIEST TO USE? ROWEASY:_____

MASTER(1) [ ] SANITAS(2) [ ] SAME(3) [ ]

3. WHICH PLANTER WENT IN A STRAIGHT LINE BETTER? STRLINE:_____

MASTER(1) [ ] SANITAS(2) [ ] SAME(3) [ ]

4. WHICH PLANTER PRODUCED A PLOT WITH GREATER YIELD? GTRYIELD:_____

MASTER(1) [ ] SANITAS(2) [ ] SAME(3) [ ]

5. WHICH PLANTER HAD MORE GAPS IN THE ROWS? GAPFILL:_____

MASTER(1) [ ] SANITAS(2) [ ] SAME(3) [ ]

6. WHICH PLANTER REQUIRED YOU TO DO MORE THINNING? THINNING:_____

MASTER(1) [ ] SANITAS(2) [ ] SAME(3) [ ]

7. WERE THERE ANY OTHER PROBLEMS WITH THIS TRIAL? PROBLEMS:_____ (POSTCODE)
(INCLUDE INSECTS AND BIRDS HERE)

_____

_____

_____

_____

8. ARE YOU PLANNING TO USE ONE OF THESE PLANTERS ON A LARGER PART OF YOUR FIELD NEXT YEAR? ADOPTION:_____

YES(1) [ ] OR NO(2) [ ]

6. SINGLE SUPER PHOSPHATE VS. UNFERTILIZED

DVDU:_____

1A. WOULD YOU USE FERTILIZER AGAIN? USEAGAIN:_____

YES(1) [ ] OR NO(2) [ ]

1B. IF YES, WHY?_____ WHYUSE:_____

_____

2. HOW WERE CONDITIONS WHEN YOU PLANTED? SOILMOIS:_____

TRIAL PLOT		CHECK PLOT
_____	OPTIMAL MOISTURE(1)	_____
_____	TOO DRY TO PLANT(2)	_____
_____	TOO WET TO PLANT(3)	_____

3. WAS THE NUMBER OF PLANTS IN THE TRIAL PLOT GREATER OR LESS THAN IN THE TRADITIONALLY PLOUGHED PLOT? PLNTNBR:_____

GREATER(1) [ ] LESS(2) [ ] OR THE SAME(3) [ ]

4. DID THE PLANTS GROW FASTER OR SLOWER IN THE TRIAL PLOT THAN IN THE TRADITIONAL PLOT? GROWFAST:_____

FASTER(1) [ ] SLOWER(2) [ ] OR THE SAME(3) [ ]

5A. DID YOU RE-PLANT ANY OF THE PLOT AREAS? RE-PLANT:_____

YES(1) [ ] OR NO(2) [ ]

5B. IF YES, WHICH PLOT WAS RE-PLANTED? WHICHRPL:_____

TRIAL(1) [ ] TRADITIONAL(2) [ ] OR BOTH(3) [ ]

6A. DID YOU THIN ANY OF THE PLOT AREAS? THIN:_____

YES(1) [ ] OR NO(2) [ ]

6B. IF YES, WHICH PLOT WAS THINNED? WHCHTHIN:_____

TRIAL(1) [ ] TRADITIONAL(2) [ ] OR BOTH(3) [ ]

7. DID YOU SEE ANY DIFFERENCE IN THE KINDS OF WEEDS? KINDWEED:_____

YES(1) ☐ OR NO(2) ☐

8A. DO YOU THINK WEEDING WAS MORE OR LESS WORK FOR THE TRIAL PLOT THAN FOR THE TRADITIONAL PLOT? WEEDWORK:_____

MORE THAN(1) TRADITIONAL ☐ LESS THAN(2) TRADITIONAL ☐ OR THE SAME(3) ☐

8B. WERE THERE ANY PARTICULAR PROBLEM WEEDS? PROBWEED:_____ (POSTCODE)

_____

8C. WERE THESE IN THE FIELD LAST YEAR? LASTYRPB:_____

YES(1) ☐ OR NO(2) ☐

9. WERE THERE ANY OTHER PROBLEMS WITH THIS TRIAL? (INCLUDE INSECTS AND BIRDS HERE) PROBLEMS:_____ (POSTCODE)

_____

_____

_____

_____

10. WOULD YOU LIKE TO TRY THIS SYSTEM AGAIN NEXT YEAR? TRYAGAIN:_____

YES(1) ☐ OR NO(2) ☐

11. ARE YOU PLANNING TO USE THIS SYSTEM ON A LARGER PART OF YOUR FIELD NEXT YEAR? ADOPTION:_____

YES(1) ☐ OR NO(2) ☐

7. CAPTAN TREATED GROUNDNUT SEED VS. UNTREATED GROUNDNUT SEED

DVDU:_____

1. DID MORE OF THE TREATED SEEDS EMERGE THAN THE NON-TREATED SEEDS? TREMERBE:_____

MORE(1) ☐ LESS(2) ☐ SAME(3) ☐

2. DID THE TREATED SEEDS EMERGE BEFORE THE NON-TREATED SEEDS? MOREEMER:_____

BEFORE(1) ☐ AFTER(2) ☐ SAME(3) ☐

3. WAS THE NUMBER OF PLANTS IN THE TRIAL PLOT GREATER OR LESS THAN IN THE TRADITIONALLY PLOUGHED PLOT? PLNTNBR:_____

GREATER(1) ☐ LESS(2) ☐ OR THE SAME(3) ☐

4. DID THE PLANTS GROW FASTER OR SLOWER IN THE TRIAL PLOT THAN IN THE TRADITIONAL PLOT? GROWFAST:_____

FASTER(1) ☐ SLOWER(2) ☐ OR THE SAME(3) ☐

5A. DID YOU RE-PLANT ANY OF THE PLOT AREAS? RE-PLANT:_____

YES(1) ☐ OR NO(2) ☐

5B. IF YES, WHICH PLOT WAS RE-PLANTED? WHICHRPL:_____

TRIAL(1) ☐ TRADITIONAL(2) ☐ OR BOTH(3) ☐

6A. DID YOU THIN ANY OF THE PLOT AREAS? THIN:_____

YES(1) ☐ OR NO(2) ☐

6B. IF YES, WHICH PLOT WAS THINNED? WHCHTHIN:_____

TRIAL(1) ☐ TRADITIONAL(2) ☐ OR BOTH(3) ☐

7. DID YOU SEE ANY DIFFERENCE IN THE KINDS OF WEEDS? KINDWEED:_____

YES(1) ☐ OR NO(2) ☐

8A. DO YOU THINK WEEDING WAS MORE OR LESS WORK FOR THE TRIAL PLOT THAN FOR THE TRADITIONAL PLOT? WEEDWORK:_____

MORE THAN(1) TRADITIONAL ☐ LESS THAN(2) TRADITIONAL ☐ OR THE SAME(3) ☐

8B. WERE THERE ANY PARTICULAR PROBLEM WEEDS? PROBWEED:_____ (POSTCODE)

_____

8C. WERE THESE IN THE FIELD LAST YEAR? LASTYRPB:_____

YES(1) ☐ OR NO,2) ☐

9. WERE THERE ANY OTHER PROBLEMS WITH THIS TRIAL? (INCLUDE INSECTS AND BIRDS HERE) PROBLEMS:_____ (POSTCODE)

_____

_____

_____

_____

10. WOULD YOU LIKE TO TRY THIS SYSTEM AGAIN NEXT YEAR? TRYAGAIN:_____

YES(1) ☐ OR NO(2) ☐

11. ARE YOU PLANNING TO USE THIS SYSTEM ON A LARGER PART OF YOUR FIELD NEXT YEAR? ADOPTION:_____

YES(1) ☐ OR NO(2) ☐