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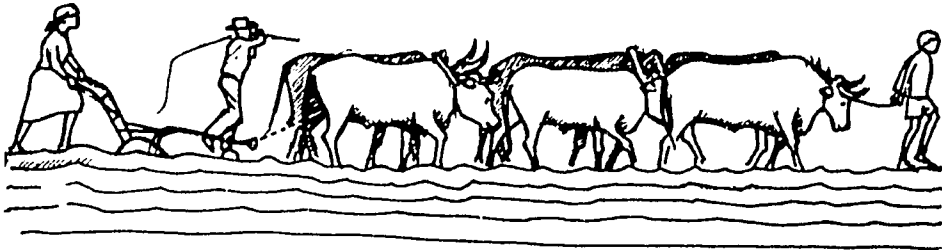
FARMER TRAINING IN ROW PLANTING AND MECHANICAL
WEEDING

BY

J. SIEBERT, E. MODIAKGOTLA, L. MALATSI AND A. CAPLAN

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Agricultural Technology Improvement Project
Department of Agricultural Research
Ministry of Agriculture
P/B 0033
Gaborone
Botswana

Telephone 352381 Ext. 260
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EXECUTIVE SUMMARY

This report assesses several farming training courses held in the Central Agricultural Region. These training courses are being developed to improve the extension of a row planting package: early ploughing, quality planting and mechanical weeding. Parts of this report are from a follow-up study to training in 1988, conducted by farming systems research.

The report is prepared for the District and Regional Agricultural officers who plan and conduct these courses. Additionally, this information could be of interest to planners in the Ministry of Agriculture. For persons outside of the Central Agricultural Region, the report provides an explanation of how different agencies of the Ministry of Agriculture can work in a collaborative effort.

Participation by various agencies of the Ministry of Agriculture has been good, but on an *ad hoc* basis. The courses are viewed as a success, and plans are to continue and expand this type of activity.

The quality of row planting achieved by participants is better than that seen for most row planting by farmers in the region. However, participants who borrowed or hired planting equipment, often failed to row plant large areas and most participants failed to use a mechanical weeder. The farmers explained that the main reason for failing to row plant and weed with a cultivator was because of a shortage of labour. The recommendation presented at training on early ploughing and planting to optimize planting moisture was also not followed in a satisfactory manner.

Some recommendations for future training are as follows:

- (a). Continue the type of hands-on training to develop skills used thus far in the courses.
- (b). Increase the emphasis on an early ploughing strategy for the farm to complement the shift to row planting.
- (c). Work at solving the labour shortage problem by:
 - i. Inviting all individuals of a household who work with planting and mechanical weeding to train as a unit.
 - ii. Inviting more women to the training and to work with the mechanical field operations.
 - iii. Promoting labour sharing arrangements between labour poor households for row planting and mechanical weeding.
- (d). Plan training to reduce cost per course.
- (e). Plan participation by agencies of the Ministry of Agriculture so that each is making an appropriate contribution.
- (f). Develop a systematic extension follow-up to support the shift to row planting and to re-emphasize messages given during training.
- (g). Identify issues in the adoption of the row planting that can be addressed in the on-farm research programme.

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Following the initial 1987 training, the District Agricultural Officer for Machaneng, Mr. L. Malatsi, and his staff took the lead in developing the training format.

K. Seleka was responsible for data entry.

This paper has been reviewed by D. W. Norman and J. W. Snyder of the Agricultural Technology Improvement Project; M. Malobe, the Regional Agricultural Officer for Central Agricultural Region; F. F. Makgetle, ALDEP Crop Production Officer for Central Agricultural Region and Mr. G. Ramolemana, Research Extension Liaison Officer, Department of Crop Production and Agro-Forestry.

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1. INTRODUCTION

1.1 BACKGROUND

Agricultural agencies in the regions have been asked by Ministry headquarters to develop ways of working together to be more effective at improving crop production on the farm. In the Central Agricultural Region, collaboration between research, ALDEP, the District Agricultural Office (DAO), and the Mahalapye Rural Training Center (MRTC) has centered on row planting. At least four reasons can be given for why the collaborative work emphasizes row planting.

On-farm research results show that row planting is the best single option to introduce into the farming system. In addition to benefits inherent to better seed placement through row planting, other improvements can readily be added (e.g., deep and early ploughing, use of fertilizer, faster planting on good moisture -- see Appendix) once the shift is made to row planting.

Generally, adoption of row planting is hindered by lack of experience and skills. The rate of adoption in the Central Agricultural Region is low (Singh, Kelly, and Motsemme, 1980-1985) even though many farmers have indicated that they would like to row plant (ATIP, 1986a). On-farm research participants, not experienced or trained, are often not successful at row planting (ATIP, 1986b) indicating that training would be useful. Other options do not need new skills in the same way. Use of double ploughing, for instance, can be effectively extended through simple demonstration plots. Row planting needs training.

Both on-farm research and extension in the Central Agricultural Region consider row planting a high priority. This is important for establishing collaboration. Collaboration will not be sustained when joint activities focus on themes of low priority.

Collaborative work needs to be focused on one or two themes at most. The attention of research staff, extension staff and farmers could be lost if other themes are introduced before work on the row planting package is developed.

The collaborative programme has come to consist of three elements: research into row planting related technology, demonstration of row planting through contests held at District Agricultural Shows, and training courses for farmers interested in row planting. The on-farm portion of the research element includes work on banding fertilizer, evaluation of planter and cultivator equipment and simple tillage systems. The Agricultural Show demonstration contests have been held for the last two years in several agricultural districts. Training courses were begun in 1987. This report assesses farmer training in row planting.

1.2 OBJECTIVES

The purpose of this report is to feed information back to District and Regional Agricultural officers who plan and conduct field training courses. This information could also be of interest to planners in the Ministry of Agriculture. Recommendations are given on how the course, or follow-up to the course, might be improved.

The specific objectives are as follows:

- (a). To evaluate the effectiveness of training from what participants did on their own.
- (b). To assess the organisation and sustainability of this type of training.
- (c). To identify continuing problems in the implementation of row planting by farmers.

- (d). To provide recommendations for future training.
- (e). To identify issues that should be addressed by research.

1.3 METHODS

Part 3 of this report is from a follow-up study to the two 1988 farmer training courses. Twenty-nine participants from the Chadibe and Palapye courses were interviewed, on three occasions, by research and extension staff. The first interview, during training, was used to identify household characteristics and previous experiences with row planting. The second, conducted between March and the end of April, coincided with the completion of tillage and planting, and field measurements were made at that time. The final interview followed harvest. Few harvest time interviews were made and these data are not used in this report. Leaving harvest results out is unfortunate, but the key concern with problems in row planting and mechanical weeding is adequately dealt within the second interview.

2. ORGANISATION OF THE TRAINING COURSES

2.1 REVIEW OF PAST TRAINING COURSES

Although the goal of all the training has been to introduce a quality row planting package into the farming community, the purpose of individual training courses has changed.

In 1987, ATIP/DAR sponsored farmer training as the initial stage in the testing of a custom-hire scheme for row planting. The Palapye Development Trust and research officers from the Farm Machinery Development Unit (FMDU) helped in providing practical hands-on training at the Mahalapye Research Sub-Station. Participants were selected for their entrepreneurial goals and because they had sufficient draught and labour resources to work on many hectares and farms in their home village.

Double row planter units were introduced at this training because these would increase the area that could be planted on days with good soil moisture. Unfortunately, these units were not considered satisfactory¹ and participants chose to work with single-row planters.

Results for the custom-hire scheme were mixed. Only two trained operators actively engaged in custom-hire row planting. However, it proved to be profitable (under ARAP) for both the operators and host farmers. Little mechanical weeding, however, was done. The main constraint cited for limited participation and for lack of mechanical weeding was a shortage of labour during periods other than school holidays.

It became apparent that serving as operators in a custom-hire scheme, though profitable, would play a limited role among most families who work their own fields. The work on custom-hire was dropped from the research villages and discussed only as a possibility for the larger villages where interested, trainable and underemployed labour could be recruited.

In 1987-88, the DAO Machaneng assisted in arranging host farmers of the custom-hire scheme in Makwate, and later proposed that research and extension collaborate in a training course at Chadibe. The Chadibe course was held in the winter of 1988 and was targeted to

¹. The double unit Sebele Standard planter was too bulky and heavy, the Makgonatsotlhe unit was designed for oxen and participants wanted to use donkeys, a single S-90 unit functioned, but needed spares which were not available.

farmers who had obtained planters through ALDEP. The course included a few farmers experienced in row planting. A second training course was organised in the same year at the Palapye Development Trust. Most participants at Palapye were already involved in research associated with row planting, under the auspices of ATIP. As might be expected, a majority of these farmers did not yet own planters but indicated that they would borrow equipment during the coming season. Farming systems research administered a follow-up questionnaire to 29 participants in these two courses. A field assessment accompanied this questionnaire.

In 1989, the DAO Machaneng and his staff again organised a collaborative training course which was held in Ramokgonami. Extension area ADs took the lead in selecting participants from nine different areas. A few experienced farmers were included as co-trainers, but most of the 45 participants were farmers who had just obtained planting equipment. An attempt was made to recruit a team, not just the head person, from the participating households and to recruit women. In ten cases, husband and wife participated. In 1989, 19 women participated compared with only one at the Chadibe course in 1988. Reasons for encouraging the involvement of women are discussed under Section 4.4.

2.2 TOPICS COVERED

Trainers have been recruited to address or supervise the following topics in the training:

- (a). Knowledge of and developing hands-on experience with planters.
- (b). Knowledge of harness and yoke arrangements.
- (c). Row spacing and row straightness.
- (d). Knowledge of and developing hands-on experience with cultivators.
- (e). Tillage strategies to use with row planting.
- (f). Animal condition and animal training required for early field work.
- (g). Changes in farm management needed to make row planting profitable.

For training to be effective, key messages need to be identified before the course commences. Even though new ideas might arise during the training, each trainer should start with a basic set of messages. A post-training review of the agenda also proved useful for outlining future training.

2.3 TRAINERS

Trainers were recruited for their practical qualifications. Individuals from ALDEP, the District office, the Palapye Development Trust, the RTC, DAR, and a few experienced farmers were involved. The contribution of farmers at the Ramokgonami course was noteworthy. Experienced farmers are often effective communicators to other farmers. ADs have not played a large role as trainers, but their role becomes more important as they acquire practical knowledge. In this respect, the training course provides an environment in which participants, government officers and farmers, can contribute and learn together.

A large training input from senior officers into every course cannot be possible if training is expanded.² For the programme to be sustainable, the corps of trainers probably should consist of farmer trainers, selected ADs and District staff, Rural Training Centre instructors,

² Additionally, senior agricultural officers are not always the most effective practical trainers.

with on-farm research giving support.

2.4 COMPARISON OF FIELD TRAINING WITH TRAINING AT THE RTC

The field training course is held in a village area. Farmers say that the village and farm field create a good environment for such training. Because participation by local farmers is easiest and their numbers tend to be the highest, the local village becomes the target for promotion of row planting. Training can even be successful in villages that do not have a history of row planting. Ramokgonami, the 1989 venue, is not thought to have had row planting farmers before the current season.

Also note that the agenda of these courses is focused on one key subject and more oriented towards practical experience. Trainers come with more practical skills in the topics of the course than is customary in crop production training at the RTCs.

2.5 ESTIMATE OF COST FOR COURSE

The cost of these courses becomes an important issue for the Ministry if the training programme is to be expanded. Major expenditures, in addition to normal salaries for government officers, include: food, accommodation, transportation of trainers and farmers, overnight allowance for government officers, and casual labour.

An estimate of food cost (Table 2.1) is based on what the Training Centre charges (per person, per day) plus the amount spent by ATIP/DAR during the most recent course³.

TABLE 2.1: ESTIMATED COST FOR FOOD PER PARTICIPANT

ITEM	PLA/PARTICIPANT/DAY
Breakfast (MRTC)	1.25
Lunch (MRTC)	2.75
Dinner (MRTC)	2.00
Supplemental Meat (DAR)	<u>1.00</u>
Total	<u>7.00</u>

Accommodation can be provided cheaply in the village areas. In 1988, government tents were used. In 1989, a local primary school was used.

Transportation costs have not been estimated, but would be reduced considerably if only a few trainers are needed and if farmers participate in training near their homes. Transportation costs for participants should not differ from what they are presently for participation in courses held at Rural Training Centres.

Likewise, officers' time and overnight allowance are most costly when many officers attend the course. Until now, their attendance has been warranted in order to encourage diverse

³. Farmers in the courses suggested that the quantities of filling foods; such as bogobe, bread, etc., should be increased. These are needed because the training involves considerably more manual effort than in normal Rural Training Centre courses. On the other hand, participants indicated that condiments such as tomato sauce and mayonnaise are not required at meals in the field.

input into the development of the courses. A more sustainable participation could be achieved with one AD per three or four of his/her farmers, plus four or five specialist trainers and organisers for a group of no more than 40 farmers. MRTC has provided one cook and ATIP/DAR an assistant (casual labourer) for feeding about 70 participants. A minimum of four additional drivers and/or labourers are needed for driving and general assistance. Estimated cost of the course per day is given in Table 2.2.

TABLE 2.2: ESTIMATED COST PER DAY OF COURSE

ITEM	PULA/PARTICIPANT/DAY	NUMBER PARTICIPANTS	COST/DAY
Food	7.00	70	490.00
Accommodation	discounted		
Transportation	variable		
Overnight Allowance	15.00	25	375.00
Casual Labour			
Total Per Day			830.00

Thus for 40 participants, recurrent costs, not including transportation and discounting accommodation, would be about P840.00 per full day of training. Nevertheless, a three day course would cost over P2,000 and a four day course nearly P3,000. These figures show that to be cost effective, the course must be well organised with little wasted time in the schedule.

3. WHAT PARTICIPANTS DID ON THEIR OWN

3.1 PLOUGHING, PLANTING AND MECHANICAL WEEDING

Of the 39 participants in the two 1988 courses, 29 were monitored during the cropping season. As shown in Table 3.1, 267.9 hectares were planted by the monitored group which averages to 9.24 hectares/participant. Of these 29, 19 did some row planting and 10 did none at all. The area row planted by participants was 180.6 hectares, and 36.4 hectares were weeded with a cultivator.

TABLE 3.1 PLOUGHING, ROW PLANTING AND MECHANICAL WEEDING FOR PARTICIPANTS

GROUP OF PARTICIPANTS	NUMBER	TOTAL HECTARES	ROW PLANTED HECTARES	MECH.WEED HECTARES	PERCENT OF HA.COMPLETED*
Monitored	29	267.9			
Row Planting	19	206.6	180.6		87.4
Mech. Weeding	6	73.6		36.4	49.5

* Refers to the percent of area ploughed by row planting farmers that was row planted, and to percent of area ploughed by farmers using a cultivator that was mechanically weeded

Following training, the percentage of farmers who row planted on their own was disappointing. The late beginning of rainfall in 1988-89 hindered field work, but, nonetheless, many farmers demonstrated that row planting, on a large scale, was possible. For farmers who started row planting, 87 percent of the area ploughed was row planted. This result suggests that all elements associated with row planting (e.g., interest, skill, labour, equipment, draught) must be in place before it is adopted by the farmer⁴.

⁴ However, because broadcast plots can fill special niches in the system, a little broadcast seeding should be expected in most seasons. Broadcast and single ploughing needs almost no land preparation and seeding is without delay. For example, small early

3.2 COMPARISON OF IMPLEMENTATION FOR NEWCOMERS AND EXPERIENCED ROW PLANTING FARMERS AND FOR ACCESS TO EQUIPMENT

In Table 3.2, the information from Table 3.1 is partitioned to compare the effect of row planting experience and access to planting equipment on what is accomplished in the field.

TABLE 3.2: PLOUGHING, ROW PLANTING AND MECHANICAL WEEDING BY EXPERIENCE AND ACCESS TO EQUIPMENT

GROUP OF PARTICIPANTS	NUMBER - TOTAL FRW ^a		PLG HA/FARM OVERALL FRW		ROW PLT HA AVG./FRW	CULT HA AVG./FRW
Newcomer - Own	6	4	7	6	5	0
Newcomer - Borrow	6	1	6	8	8	0
Newcomer - Hire	0	0	-	-	-	-
1 year experience - Own	6	5	8	10	7	2
1 year experience - Borrow	2	1	5	3	2	0
1 year experience - Hire	0	0	-	-	-	-
2+year experience - Own	8	8	15	15	14	3
2+year experience - Borrow	0	0	-	-	-	-
2+year experience - Hire	1	0	10	-	0	0

- a. FRW stands for farmers who row planted during 1988-89 season.
 b. PLG = Ploughed, PLT = Planted, CULT = Cultivated.

In 1988-89, training failed to reach farmers who did not own their own equipment. Only two out of the nine farmers who borrowed or hired equipment, row planted. Many of these were also newcomers. None of the newcomers used a cultivator for weeding. But for owners of equipment, 17 of the 20 row planted.

3.3 EVALUATION OF THE QUALITY OF ROW PLANTING

Row quality (Table 3.3) was excellent for newcomers and farmers experienced with row planting, following the training course. With the exception of some parts of a few fields, row quality was satisfactory for all participants that row planted.

3.4 SECONDARY TILLAGE OPERATIONS PERFORMED BY THE MONITORED GROUP OF PARTICIPANTS

Three of the 29 monitored participants did use some type of secondary tillage before planting. One of these used a Sebele plough-planter. This farmer double ploughed half of the 11 hectares with the plough-planter used for the second ploughing.

Another farmer used a harrow before row planting on 70 percent of the 5.5 hectares planted. Because of results from earlier on-farm trials (ATIP, 1985b), research trainers have discouraged the use of harrows except when clod size was excessive. In this case, plant establishment was poor over most of the area where the harrow had been used.

broadcast plots can produce melons, merogo, and other produce for immediate consumption while later row planting would still be maturing in the field. Broadcast and ploughing can also be used to take advantage of rainfall late in the planting season for which the farmer is not prepared.

TABLE 3.3: ROW QUALITY FOR PARTICIPANTS

GROUP OF PARTICIPANTS	NUMBER FARMS	AVG. ROW STRAIGHT (RATING)	AVG. ROW SPACE (CM)	AVG. POT. CULT. (RATING)
Newcomer	5	1.87	71.0	1.41
1 year experience	6	1.92	76.2	1.38
2+ year experience	8	1.50	79.8	1.17
Statistical Significance ^c		ns	ns	ns

- a. Straightness of rows: 1 = excellent, 2 = good, 3 = fair, 4 = poor.
 b. Potential to inter-row cultivate: 1 = well, 2 = with difficulty, 3 = cannot cultivate.
 c. ns = non-significance.

A father-son combination, in Sefare, double ploughed 90 percent of the son's field before row planting. Unfortunately, the father's own field was not monitored. Under the cooperative arrangement, five hectares were double ploughed and row planted, for the son, with good results. This is an excellent example of how a cooperative arrangement can serve to facilitate tillage and planting on a large and intensive scale.

3.5 IMPACT OF PLOUGHING BEFORE THE PLANTING DATE

In the discussion on tillage strategies, research trainers suggested that farmers plough as early and deeply as possible. When farmers wait for rain after ploughing, planting should be concentrated on good soil moisture. In Table 3.4, an evaluation is made of what happened when farmers waited an interval of days between ploughing and row planting. These ratings were made on individual plots within fields.

TABLE 3.4: EFFECT OF TIME INTERVAL BETWEEN PLOUGHING AND ROW PLANTING

INTERVAL (DAYS)	PLT. MOISTURE RATING	AVG. PLG DATE	AREA (ha) (%)	PRE. WEED. RATING	PLT. STAND RATING
0	1.88	02.01.89	38.75 22.6	2.53	2.03
1-2	1.63	01.01.89	53.18 31.0	3.20	1.83
3-7	2.57	09.01.89	6.32 3.7	2.00	2.57
8-14	2.65	11.12.88	38.90 22.7	2.43	2.26
15 +	2.25	29.11.88	34.30 20.0	3.65	1.95
Statistical Significance ^g	**	**		ns	ns

- a. Ploughing-planting interval category.
 b. Soil moisture at planting. Rated by farmer: 1 = excellent, 2 = good, 3 = fair, 4 = poor. (Note: No planting on excessive moisture was indicated).
 c. Date corresponding to average julian day for ploughing of all plots in sample.
 d. Sum of area (ha.) in sample for each ploughing-planting interval category.
 e. Weed burden prior to weeding. Rated by farmer: 1 = light, 2 = moderately light, 3 = moderate, 4 = moderately heavy, 5 = heavy.
 f. Crop plant stand. Rated by research staff and extension AD: 1 = excellent, 2 = good, 3 = fair, 4 = poor.
 g. ns = non-significance, ** = significant at .01 probability.

Of particular note in this table is the "moisture at planting" column. Although we do not know if farmers delayed their planting intending to wait for better soil moisture, where participants did delay planting, they generally failed to wait for ideal soil moisture. Planting moisture for delayed plantings should be much better than those observed.

The results also show that plant stands were variable, but generally satisfactory for most farms (average rating was two, i.e., good).

3.6 FARM MANAGEMENT FOR LARGE SCALE ROW PLANTING

It is important that ADs explain to farmers about the changes in farm management needed to successfully shift to row planting. Farmers who row plant large portions of their field using animal traction tend to spend more days working, and are prone to begin operations earlier than their counterparts who row plant less or who only broadcast and plough (Table 3.5). Farmers row planting on a large scale also plough more hectares than other farmers. These data do not separate farms with more than one traction team doing the work.

TABLE 3.5. DAYS SPENT PLOUGHING AND PLANTING; DATE OF FIRST FIELD WORK

AREA ROW PLANTED (HA)	NUMBER FARMERS	AVG. HA. PLOUGHED	AVG. NO. DAYS FOR PLOUGHING/PLANTING	AVG. DATE OF 1ST FIELD OPERATION
0	10	6.2	4.3	12 Jan
1-3	2	5.0	5.0	23 Jan
4-10	8	8.2	9.3	7 Dec
10 or more	9	14.2	14.4	13 Nov

4. CONCLUSIONS FROM RESEARCH FOLLOW-UP STUDY

4.1 ROW PLANTING QUALITY AND TRAINING

Following training, the quality of rows on most farms was good. This is in contrast to what has occurred in on-farm trials where farmers did not have the benefit of "hands-on" training. In trials, similar recommendations on row spacing and straightness were offered, but were not followed as well as what occurred after training, and most plots could not be mechanically weeded.

Overall, it appears that the training courses are providing a useful means of developing skills in handling the planter. Even when cultivators were not used, weeding would have been possible. Also, even though conditions were dry and not conducive for good plant establishment, participants did manage to achieve respectable plant stands through row planting.

4.2 TILLAGE AND ROW PLANTING

The message conveyed during training was for farmers to practice early ploughing or at least ploughing prior to a planting rain, known as modified early ploughing, (ATIP, 1985c). Ploughing before the planting rain usually improves the moisture at planting. Trainers explained that, above all, the ploughing strategy should be flexible. Good planting opportunities should never be missed even when ploughing has just been completed. The strategy in ploughing for row planting is to use the ploughing to create good planting situations over as much of the field as is possible.

A few farmers used some form of secondary tillage (double ploughing or harrowing) following early ploughing and before planting. However, there was no indication that this was required or that the secondary operation benefited planting or the crop. Poor plant establishment was associated with use of the harrow (Section 3.4). Again the use of secondary tillage, as with the timing of primary tillage, should be contingent on the circumstances. Harrowing should only be necessary when clods are large and impede the operation of the planter. Double ploughing (and use of a cultivator for secondary tillage at planting time) will sometimes benefit planting on early ploughed land but may not always be necessary. Most farmers do not use secondary tillage. Use of double ploughing and

cultivation, following early ploughing and before planting, should be handled on a contingency basis. With heavy weed growth or re-compacted soil, these operations may be necessary. For farmers working with animal traction, most land that has been ploughed early can still be row planted without secondary tillage. Weeds can usually be controlled with inter-row cultivation.

4.3 ROW PLANTING EQUIPMENT

Several equipment related problems were identified during training and in the follow-up visits. Problems that can be readily defined and for which it would be relatively easy to find solutions, are as follows:

- (a). Several farmers in the Ramokgonami course had just obtained Sebele Plough Planters but without the correct attachment bracket that fits the unit to the P23 two-furrow plough. This points to a need for a better list checking of the components of manufactured units before they are sent to farmers.
- (b). Quality control on manufacturing needs to be upgraded. Farmers in follow-up studies and at Ramokgonami indicated that thin metal parts of the Sebele Standard units were prone to damage.
- (c). Several farmers have indicated that the planter units should come with tools for making adjustments. Such tools are provided with equipment imported from outside the country.
- (d). In the follow-up survey, better access to spare parts for planters was cited as an important need by farmers with several years planting experience. FMDU, working together with RIIC, should design an assortment of the most necessary nuts, bolts, washers (including the vinyl washer on the outside of the seed agitator shaft). This assortment could be placed in each extension area. Because these items would need to be sold to farmers, the spares assortment is something that could be sold through a local merchant. If local merchants are not willing to provide this service, sales could be organised through the DAO.

4.4 LABOUR FOR ROW PLANTING AND MECHANICAL WEEDING

Shortage of labour is cited as a major constraint by participants who failed to row plant, who row planted only a small part of their field, or who failed to use a mechanical weeder. A typical participant's situation went as follows. The man of the house wanted to begin row planting, obtained the ALDEP row planting package and attended the training course. Back on the farm, he was assisted by the children and the women of the household in ploughing and some row planting. Once the children were back in school, planting stopped and mechanical weeding was never started. Women of the household did not feel competent enough to work with these mechanized operations.

Research advised that more women (wives of male participants and other women of the village) should be invited for training. The potential benefits are threefold:

- (a). If training is offered to all members of a household, then they will be able to work together as a team on their own field.
- (b). Women could alleviate the labour shortage problem for row planting and mechanical

weeding in many households.

- (c). Women (and men) from two households could pool labour to row plant or mechanically weed.

The AD can emphasize the weeding benefits to encourage potential women participants.

4.5 EXTENSION FOLLOW-UP

The extension follow-up to training will be one of the most important factors affecting whether this activity is successful. Good tillage and row planting need good farm management. Systematic extension follow-up visits to encourage early preparation of equipment, draught and labour will help to begin tillage work early and to row plant larger areas.

5. RECOMMENDATIONS FOR DEVELOPING TRAINING ON ROW PLANTING

5.1 ORGANISATIONAL WEAKNESSES OF PAST COURSES

The following is a short list of the problem areas that, once resolved, would strengthen the programme.

- (a). Courses are not in the annual budget of the MRTC.
- (b). Courses are not part of the annual schedule of the District or Regional Agricultural Offices.
- (c). There is only a minor involvement of RELO in the planning.
- (d). There is no involvement of RAO in the planning
- (e). The involvement of ADs has improved, but they still need a better outline of what is expected of them.
- (f). A training guide should be created.
- (g). A systematic extension follow-up should be included.

5.2 RECOMMENDATIONS FOR TRAINING

The first recommendation is to organise more systematic extension follow-up to the course. Regular visits to participants, before and during the planting period, can be used to encourage and give advice to the farmer and AD. This follow-up could be developed around row planting farmers meeting as a group in a village.

To help resolve the labour shortage, training should be extended to the female members of households. These women might be part of a husband and wife team or women from households without male labour. The participation of women will need to be studied during training and planting season.

A second strategy to solve the problem of labour shortage could be labour pooling between labour-poor households. Women from two or more female-headed households who are interested in pooling labour should be recruited for training. This option needs to be discussed with farmers during the follow-up study.

A researcher from the Rural Sociology Unit should be invited to participate at the training session and in the research follow-up. The rural sociologist is most qualified to lead the assessment of female participation, cooperative labour pooling arrangement, and farmer

assessment of training.

The committee for the training should organise separate research and extension follow-ups. The research follow-up is a single visit study for the purpose of collecting information such as found in this report. Farming systems research and the Rural Sociology Unit should cooperate with extension staff in this study. The extension follow-up should consist of multiple support visits to participants.

5.3 PARTICIPATION OF MINISTRY OF AGRICULTURE AGENCIES

All Ministry of Agriculture agencies have a responsibility to serve the farmer. Yet each must function in a way consistent with the mandate laid down by the Ministry (i.e., research is responsible for research, etc.). Collaboration between agencies sometimes poses a dilemma. Following are some ideas on how agricultural agencies could contribute to a collaborative training programme.

- (a). *Agricultural Demonstrators*: Conducting training courses can provide the ADs with useful, practical information to give their farmers. ADs must take a lead in recruiting participants and working with farmers and trainers during the training. They are also the key group in the extension follow-up to the training.
- (b). *District Agricultural Office*: The DAO and his staff should take responsibility for planning farming training courses that are conducted in villages. Following the experience of last season, it is clear that the DAO and staff, working with the ADs, need to develop a systematic extension follow-up programme for farmers who have participated in the training sessions.
- (c). *Regional Agricultural Office*: The RAO has not been involved in the planning of the training courses because it was assumed that this was a district level activity. However, the DAO often needs support in terms of materials and help in contacting outside people. The RAO, working with the RELO, could assist in arranging logistical support and coordinating linkages with research, with the RTC, etc. The RAO, together with the RELO, could be responsible for extending training to other Districts.
- (d). *Rural Training Centre*: The RTC provides material and support staff for trainers and to help with meal preparation. This assistance will continue if training is included in the annual calendar and budget. A training guide should be put together for this type of training. This guide would enable new or inexperienced trainers at the RTC to more quickly step in and contribute.
- (e). *ALDEP*: Training on row planting is an extension activity that connects well with the promotion of the ALDEP row planting equipment package. Numerous equipment issues have surfaced during training and follow-up, and ALDEP is in the best position to address or follow-up on these concerns. ALDEP could also provide equipment for use during training (e.g., a small pool of equipment used on a rotating basis for courses in the Central Agricultural Region). Regional ALDEP trainers could work with extension staff in conducting the training sessions.
- (f). *Farming Systems Research (ATIP/DAR)*: Research can play a problem-solving role in what is mainly an extension activity. In the past, ATIP/DAR has given much logistical support for organising training. This does not seem to be the best role for FSR/DAR. However, research can contribute to training in several ways: with

trainers, with research information, and with a study follow-up to the course. The follow-up study would focus on what farmers do on their own, identify weaknesses in training and farmer recruiting, and evaluate technical and household constraints that limit the correct use of what is taught. Research can also pose possible solutions to the problems that are identified. For example, the extension follow-up was proposed by research to improve implementation by farmers that borrow equipment. The suggestion to introduce female members of households to planting and cultivating was to address the labour constraint.

The follow-up study should be done in collaboration with extension. The on-farm research part of FSR/DAR can benefit from this collaboration. For instance, the current FSR evaluation of cultivator equipment has been changed to include a hands-on assessment of equipment by women as well as men. This is in keeping with the plan to introduce more women to cultivating.

- (g). *Research-Extension Liaison Officer (RELO)*: A more important role in organising the training courses should be given to the RELO. The RELO can provide continuity to a collaborative programme that might be lacking when key individuals in extension or research are transferred. The RELO, liaising with the RAO, can handle many logistical problems. The RELO can give advice on how agencies from research and extension should collaborate.

5.4 EXPANDING THE TRAINING PROGRAMME

The Machaneng Agricultural District staff has proposed extending training to three venues for the 1990-91 season. These would include a northern, a central and a southern village in the district. Even though expansion to more villages and to other districts is a positive step, precautions are needed.

If row planting training is expanded, greater training skills and other resources are needed in the Central Agricultural Region and in the districts. It will not be possible to recruit headquarter or Sebele staff to assist in a large number of courses. Even at the regional level, most officers will not be able to devote time to many training courses. A well structured guide for conducting training would help junior officers conduct training.

It would be helpful if planning and logistical support could be obtained from the RAO and RELO, as well as a pool of equipment and materials, and a mechanism by which the training can be regularly reviewed and modified. For this purpose, the extension and research follow-ups will be important.

If training is expanded, the focus on row planting and mechanical weeding could continue. But, other practices are also recommended and should be promoted on farms where row planting is already successfully used. In the future, it may be valuable to organise training at two levels: newcomers' training and advanced training. Newcomers' training would focus on row planting and mechanical weeding. Advanced training, as a refresher for experienced row planting farmers, could be used to introduce other technology that reasonably follows good tillage and planting, e.g., use of fertilizer -- possibly broadcast but preferably banded, soil building with kraal manure, crop rotation, water conservation terraces.

Training on row planting should be promoted to all households. Options are available that enable nearly all households to row plant. In addition to the ALDEP package, options include custom-hire, cooperative arrangements and hand operated planters. A successful increase in female participation in row planting and mechanical weeding would also greatly expand the horizon for row planting.

APPENDIX

BENEFITS IN SHIFTING FROM BROADCASTING TO ROW PLANTING

A.1 INTRODUCTION

Research on the comparison of row planting and broadcast seeding is scarce in Botswana. Results from comparisons between plots in experiments are mixed (Lightfoot, 1981; ATIP, 1985c; ATIP, 1986b), but generally show that row planting provides better percent emergence of seed and better distribution of plants. Final yields may not differ greatly. In plot comparison, broadcast with double ploughing has given higher yields than row planting (ATIP, 1987).

To correctly assess row planting, one must consider what can be achieved on a farm. The tillage and planting goals for the farm are: to conserve the most rainfall over as much land as possible, to establish a satisfactory crop stand over as much land as possible, and to reduce weed growth to a point where it can be managed by household labour.

Row planting, by separating tillage and planting, permits earlier tillage and deeper tillage than is common with broadcast planting. Rainfall conservation is also improved.

In some years, crop establishment fails because of too few days with good soil moisture for planting. Row planting, by separating tillage and planting, permits ploughing on days with drying soil or in the early season when planting is not advised. The value of row planting is in the speed with which seed can be well placed in the soil on those days appropriate for planting.

Weed control is more efficient with row planting if row quality is adequate (parallel rows of the correct spacing) and if household labour can be re-directed to inter-row mechanical weeding.

A.2 SUMMARY OF BENEFITS FROM A ROW PLANTING SYSTEM

- (a). Better percent field emergence gives a good return to seed (DAR, 1988). The return to seed issue is of greater importance for high value crops, such as cowpea and groundnut. Therefore it is not surprising to see high interest among ATIP research farmers in row planting these crops.
- (b). Better distribution of plants is likely to give a higher yield per plant. This means that 50,000 plants/hectare achieved through row planting should, on average, give a higher yield average than the same plant population achieved under broadcast.
- (c). Row planting creates the potential for mechanical weeding and therefore better return to weeding labour. The inter-row cultivation could also improve soil aeration and water infiltration during the period of crop growth.
- (d). Separation of tillage and planting gives greater flexibility when selecting tillage options. Tillage options include: early spring ploughing, early ploughing with secondary tillage, deep ploughing, winter ploughing, and ploughing with planting on the same rain.

- (e). Because row planting is faster than broadcast and ploughing, a larger area can be planted on days with ideal soil planting moisture. The speed of row planting depends on the preparation of equipment, animal teams, labour, etc., and the type and number of planters in use.

A.3 RESEARCH FINDINGS ON ROW PLANTING

A summary of some of the major research findings on row planting are as follows:

- (a). When using a tractor, the economic analysis on plot data has shown row planting to be more profitable than single ploughing/broadcast or double ploughing/broadcast even though yields with double ploughing are just as high as with row planting (ATIP, 1986c). In the latter comparison, the cost of two ploughing operations is higher than the cost of one ploughing and one row planting. The management skills, required for double ploughing would, however, be lower than for row planting.
- (b). When using animal draught, early ploughing plus row planting is also more profitable than single ploughing/broadcast (ATIP, 1986c), but there is a greater concern for the quality of row planting when using animal draught and planters. Row planting in trials has often not resulted in satisfactory plant stands or in the row spacing needed for inter-row mechanical weeding. Clearly, most farmers with little row planting experience lack the skill and knowledge needed to use this technology to its greatest advantage.
- (c). The tillage system used with row planting should be flexible and pragmatic. Trial results and the review of farmer experiences suggest the following guidelines. Ploughing should be early to maximize water infiltration and limit water loss due to raton and weed growth. Early ploughing can increase grain yield (Siebert, 1988; MacPherson, 1989). Even if tillage is not performed following the first rains of the season, indications are that row planting benefits from ploughing done anytime prior to the planting rain -- "modified early ploughing" (ATIP, 1985a; ATIP, 1985c). The best conclusion is that a flexible approach is needed for selecting tillage options. The farmer should generally plough early, generally plough before the planting rain, but always try to use days with excellent soil moisture and with land prepared for planting regardless of when tillage was done.
- (d). Secondary tillage should only be done when needed. Obviously the cost of row planting is reduced if secondary tillage is not used. For resource-poor farmers doing row planting, secondary tillage should, therefore, not be used except when needed.

Harrowing is useful when ploughing has produced a seedbed that is too rough for quality row planting. However, on-farm trial results (ATIP, 1985b) show harrowing is not necessary unless there are large clods. Even then, harrowing may not be necessary if rains have soaked the land before planting. Not only has simple early ploughing yielded better than early ploughing with harrowing, excessive grass weed growth has sometimes been observed following harrowing.

Double ploughing or cultivating can produce excellent seedbeds, improve weed control, and increase yield. But these operations sometimes increase production cost without an increase in benefit. For example, a problem of weed growth following early ploughing has been observed in 50 percent of trial situations (Siebert, 1987). This means that in 50 percent of situations, early ploughing did not need to be followed with secondary tillage for weed control. In this 50 percent, row planting

could go directly on the early ploughed land. In the remaining 50 percent, weeds could usually be controlled by early inter-row weeding after planting. When the weed problem is excessive at planting, the farmer can still decide to use double ploughing or a cultivator before row planting.

In summary, research results suggest that crop production on farms can be improved by utilizing a sensible approach in which ploughing is carried out as early as possible, and is used as a way of preparing the land so that most, if not all, row planting can be on good soil moisture. For small farmers, secondary tillage should be used only when needed. Observations during research also suggest that farmers, not already competent with row planting, need instruction on how to use the row planter and mechanical weeder.

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