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Maize and Sesame Technology Adoption and Constraints

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1. Introduction

This is a paper summarized from the presentation made on " technology use and Constraints" for the workshop on " Food Security Planning & Policy" held at the Ministry of Agriculture, Mogadishu, May 31, 1987.

Although some of the information in this paper could be applicable to general aspects of crop production in Somalia, the technology use and constraint is mainly meant for maize and sesame production by the small farmers through the regions of Lower and Middle Shabelle.

The Food Security Project in cooperation with the Planning Department of the Ministry of Agriculture is undertaking a study on food security aspects through the farmers in Lower & Middle Shabelle regions with focus on maize and sesame crops.

All the tabulated data in the following sections of this paper were extracted from a primary data collected from 326 small farmers interviewed through questioners prepared by the Food Security Project.

2. Farming Land Characteristics

Land is a basic and important factor of crop production. In this paragraph we will examine some characteristics of farmers farming land such as: farm size, number of fields per farmers, land registration and rental land.

2.1. Farm Size

Table 1

Farm Size Distribution of the Food Security Study Sample (in hectare categories)

Value Label	Frequency	Percent	Valid Percent	Cum Percent
< 1.0 HA	26	8.0	8.0	8.0
1.00-1.49 HA	53	16.3	16.3	24.2
1.50-1.99 HA	29	8.9	8.9	33.1
2.00-2.49 HA	52	16.0	16.0	49.1
2.50-2.99 HA	11	3.4	3.4	52.5
3.00-3.99 HA	26	8.0	8.0	60.4
4.00-4.99 HA	23	7.1	7.1	67.5
5.00-6.99 HA	21	6.4	6.4	73.9
7.00-9.99 HA	24	7.4	7.4	81.3
10.00-14.99 HA	14	4.3	4.3	85.6
15.00-19.99 HA	7	2.1	2.1	87.7
20.00-29.99 HA	10	3.1	3.1	90.8
30.00-39.99 HA	15	4.6	4.6	95.4
40.00-59.99 HA	7	2.1	2.1	97.5
60.00-99.99 HA	4	1.2	1.2	98.8
100 HA or more	4	1.2	1.2	100.0
Total	326	100.0	100.0	

From the study of the Food Security Project, as shown in table 1, it was found out that farmers surveyed in Middle and Lower Shabelle regions, about 50% of the farmers have 2.5 hectares or less of farming land.

Farther looking into the cumulative percent of the respondent farmers, it was found that 82% of the farmers have 10 hectares or less of farm land.

Although it is difficult to dhow a line between small and large farmers, the above discussed figures show us that the big majority of farmers 82% have less than 10 HA of land, while only about 18% have more than 10 HA of land therefore, this is affect that only gives a tentative guide line for the policy makers and project donor agencies to show them the farming land distribution among the farmers in these two regions.

2.2. Number of Fields

Table 2
Number of Fields

# of fields	# of farmers	%
0	1	0.3
1	110	34.0
2	134	41.3
3	47	14.5
4	29	9.0
5	3	1.0
Total Respondents	324	100%
Missing	2	
	326	

According to table 2, out of 326 farmers interviewed, 324 of them responded to the question of number of fields that a farmer may have within his farming land.

The majority of farmers (41.3%) have two pieces of land while only 34% of the respondents had one field each, the rest 14.5% had 3 fields, 9% had 4 fields and 1% said that they had 5 fields. Only one person (0.3%) answered that he had zero fields.

Already having seen that most of the farmers own less than 3 hectors of farming land, the division of that land into smaller fields at different locations could be creating additional constraints interns of tractor use, irrigation and other production operations.

2.3. Registered Farm Land

Table 3
Registered farm land

Answer	# of farmers	%
No	171	53
Yes	153	47
Total	324	100%
Respondents Missing	2	
Total	326	

Table 3 shows that out of 324 respondents, 171 of them (53%) answered that their farming land was not registered with the Ministry of Agriculture. The rest 153 farmers (47%) have registered land.

So it was clear that more than half of the farmers in the Lower & Middle Shabelle regions did not register their land with the Ministry of Agriculture. This is creating a security problem among the small farmers in the Shabelle Valley.

This also gives an indication on the status of farm land registration among the small farmers through the country, thus else where outside the Shabelle Valley (more distant areas) could be worse.

2.4. Rent Land

Table 4
Rental Land

Answer	# of farmers	%
No	260	79.8
Yes	66	20.2
Total	326	100%

Through the interview carried out by the Food Security Project, it was found that a good portion of the farmers in the project area (20%) are renting land from other farmers. The case is either they are landless farmers or they don't have enough land for their family need. Therefore, to achieve their family food security level they are renting land from other farmers. The majority 80% of the farmers are not renting any land.

3. Farmers Asset Ownership

Table 5

Farmers Asset Ownership In Lower and Middle Shabelle 1986/87

Asset	% that have it	% that don't have it
1. Irrigation Pump.0-1	1-5	99-95
2. Tractor (0-2)	5	95
3. Cattle (0-100)	45	55
4. Camel (0-3)	2	98
5. Goats	20	80
6. Chicken (0-200)	78	22
7. Donkey (0-3)	3	97
8. Donkey Cart (0-3)	7	93
9. Shop (0-2)	7	93
10. Vehicle (0-4)	4	96
11. Others	9	91

It is known that for farmers to adopt new technology, they need either cash income or credit to buy the necessary inputs for the crop production. Since credit is not available for all farmers, in this chapter we will examine the asserts owned by the farmer that may generate income to supplement his costs of crop production.

From table 5, findings through the Food Security Programme shows a profile set of assets include machinery, livestock and others owned by the farmers, and now let us go through the list in table 5.

3.1. Irrigation Pumps

Out of the respondent to the question of irrigation pump ownership, it was found that the minimum number of pumps were zero and to the maximum of one pump owned by the farmer. Only about 3% owned irrigation pumps and seems that another 2% have excess to pumps for irrigating their fields. These could be those that use community pumps on the major canals of the area. The rest, 95% don't have pumps and thus use gravity and food irrigation.

3.2. Tractors

The survey information tabulated in table 5 shows that only 5% of the surveyed farmers have tractors. The study did not collect other specifics on the tractors such as: horse power, make, year etc. The tractor owners usually are the wealthier and bigger farmers who could buy their own tractors. The owners usually use the tractors for their farm operations mainly land preparation and rent to their neighbors.

The rest 95% don't have tractors but use tractors rented from public agency such as ONAT and from private farmers who own tractors.

3.3. Cattle

The range of the number of cattle owned by the farmer varies from 0-100. But the herd size per family is small, 3-7 heads.
In aggregate, 45% of the farmers had some cattle while the rest, 55% did not keep any cattle. The purposes for keeping cattle could be for milk, status and other reasons, while the majority who don't keep cattle could have their legitimate reasons that could lead to other studies specific for livestock related issues.

3.4. Camels

It was found that only 2% of the surveyed farmers had camels. The highest number owned was 3 and to minimum of one. The main purpose of keeping camels most probably is for the use of pressing sesame oil through the traditional oil pressing technology. But anyway 98% of the farmers don't keep camels.

3.5. Goats

Out of the data gathered, it was found that 20% of the farmers interviewed kept goats. Thus this number is less than the number of farmers who keep cattle (45%), but higher than the camel owners (only 2%). Steel we don't know the purpose & breed of goats kept by the farmers.
The majority of the respondents (80%) said that they don't have goats.

3.6. Chicken

It was found the farmers surveyed in the Lower and Middle Shabelle regions, 78% of them kept chicken, while 22% responded that they don't keep chicken. The flock size varies from few all the way to 100 birds.
The details of breeds kept and not kept production potentials could farther be studies by interested groups.

3.7. Donkeys

Only three percent of the interviewed farmers answered that they had donkeys. The rest 97% did not keep donkeys. Those who keep it mostly use it for either pulling carts for farm transports or for fetching fire wood and water.

3.8. Donkey Cart

Compared to the number of donkey owners as stated in above (3%), it was found that the donkey cart owners were 7%. The difference in number is probably that the extra carts were pulled by oxen and some were smaller and hand pushed.

3.9. Shop

The shop size could vary, but here it includes small retail shops in the villages as well as restaurants and similar businesses. It was found that 7% if the farmers in the survey area had shops, to the maximum of two shops per farmer. The rest 93% did not have shops.

3.10. Vehicles

About 4% of the surveyed farmers responded that they had some sort of vehicles to the maximum of 4 per farmer. Probably that is the wealthier portion of the farmers. But no specific information such as: size, age, value etc. was collected. The majority of farmers 96% did not have any vehicle.

3.11. Others

In this section farmers were interviewed if they had other similar assets such small processing machines, houses for storage etc.

Out the respondents 9% answered they had these other assets. The rest 91% answered that they didn't had it.

4. Extension & Technology Recommendations

At present National Extension Service (NES) is doing the extension teaching activities through the eight major agricultural regions including: Lower Shabelle, Middle Shabelle, Bay, Hiiraan, Bakol, Geddo, Middle , and Lower Jubba.
The NES staff over the eight regions consists of 176 Field Extension Agents (FEAs), 24 District Extension Office (DEOs) 8 Subject Matter Specialists (SMSs) and 7 Regional Extension Officers (REOs).

About half of the total FEAs in all the regions is operating in Lower and Middle Shabelle. That shows the emphasis of extension activities in these two regions.

The NES staff are helping the farmers in increasing their awareness in the available technology and use. Due to lack of crop and area species information from research, the extension teaching is more on general basis on crop production practices such as:

- Proper land preparation
- Use of improved seed
- Practice early planting
- Row planting
- Maintain plant population
- Proper supplementary irrigation
- Fertilizer use
- Pest control
- Seed selection during harvest and
- Proper storage methods.

5. Farmers Awareness on Technology Use

On the questionnaire of the Food Security Project surveyed through the 326 farmers in Lower and Middle Shabelle regions, it had some elements on testing the awareness of the small farmers in the use of technology, and the answers were as follows:

5.1. Contact Farmers

Farmers were asked whether they were contact farmers or not. As is shown in table 6, out of the 326 farmers 190 answered yes. That shows about 60% of the respondents were contact farmers.

Table 6
Contact Farmers

Answer	# of farmers	%
No	127	40
Yes	190	60
	317	100%
Missing	9	
Total	326	

The rest 40% were not. That means extension have done quiet considerable job in contacting and covering about 60% of the farmers in these two regions, but also there is quiet a room (about (40%) steel left for father expansion of the NES operations.

5.2. Use of Somtux Seed

Farmers were also asked whether they were aware of the use of somtux seed or not. As shown in table 7 out the 326 farmers interviewed, 248 farmers answered that they were aware of the uses of this seed.

Table 7.
Aware on use Somtux seed

Answer	# of farmers	%
No	71	22.3
Yes	248	77.7
	319	100%
Missing	7	
Total	326	

That gives about 77.7% of the respondents were aware, but the actual users of the technology were much less than that. That means although farmers were aware of the technology the actual adoption rate is bellow the 77.7%. There could be many reasons for that. For example: this Somtux maize seed is quiet new to the farmers. Also, this seed is basically produced at the Seed Multiplication Farm at Afgoi plus few contract farmers in Darasalam Village to produce the certified seed. Thus the total quantity produced per year is less than 70 tons which is way below the demand for maize improved seeds of the farmers in these two regions.

5.3. Use of Row Planting

Another question asked to the farmers was whether they were aware of the uses and advantages of row planting. As shown in table 8, about 85% of the respondents answered that they were aware of the use of that practice (row planting) but many of them did not adopt the technology, possibly due to its intensive labor requirement during planting.

Table 8
Aware on use of row planting

Answer	# of farmers	%
No	47	14.7
Yes	272	85.3
	319	100%
Missing	7	
Total	326	

The extension staff usually recommend this practice because of the advantages attached to it, such as: row planting makes easier to maintain the desired plant population, easier to apply other inputs such as pesticide and fertilizers, and also makes easier the other cultural practices such as weeding, inter cropping replanting and harvesting.

It was found that the rest (about 15%) of the respondent farmers were not aware of the uses of row planting their crops. It is either extension had never contacted them, or the concept was not clear for them, so they did not understand its importance.

5.4. Use of Maintaining Plant Population

This could be a very important practice to be adopted by the farmers. Surveying the farmers field, you find most of them don't maintain the correct plant population per unit area.

Table 9
Aware on use of plant population

Answer	# of farmers	%
No	47	14.7
Yes	272	85.3
	319	100%
Missing	7	
Total	326	

Keeping all other practices the same, a farmer by just doubling his rate of plant population, say from 25.000 plants per hector to 50,000 plants per hector, he may double the yield from his farm. This concept being so important, still many farmers don't adopt it.

The survey conducted by the Food Security Project shows (table 9) that about 85% of the respondent farmers are aware of the use of maintaining their plant population, and another 15% were not aware of the practice.

On the other hand, the adoption of this practice mainly depends on the adoption of the previous practice, row planting. Because, with out row planting, it is usually difficult to maintain the correct plant population.

5.5. Use of Insecticide

The Food Security Project have also considered the question of whether the farmers were aware of insecticide use or not. The way indicated in table 10, it was found that out the 326 farmers interviewed, 270 (85% of the respondent farmers) were aware of that input use, and another 47 farmers (15%) answered that they were not aware of its use, while 9 farmers did not answer to the question.

Table 10
Aware on use of insecticide

Answer	# of farmers	%
No	47	15
Yes	270	85
	317	100%
Missing	9	
	326	

The reason why some farmers did not adopt or use the chemical is either the chemical is not available at the right time and right quantity or they don't have access to credit to buy it, or they don't believe in using it.

5.6. Use of Fertilizers

To the question of awareness of fertilizer use, out of 326 farmers, 318 responded to the question, but 261 farmers answered "yes", and 57 farmers said "no".

That means 82% of the respondent farmers are aware of the fertilizer use, but the rate of real adoption is discussed in the following paragraph.

Table 11
Aware on use of fertilizer

Answer	# of farmers	%
No	57	18
Yes	261	82
	318	100%
Missing	8	
Total	326	

6. Examples on Maize Technology Adoption

In this paper, the discussion on the rate of adoption of technology used in crop production. But here only two practices will used as an example such as: tractor use and fertilizer application.

6.1. Tractor Use

In this paragraph the tractor use discussed is based on land preparation for maize crop in the irrigated areas of the two regions, Lower & Middle Shabelle. The question also investigates the use of Yambo (hand hoe) and the combination of tractor and yambo.

Table 12

Use Tractor For Land Preparation

Answer	# Of Farmers	Percentage (%)
Tractor	150	93.20
Tractor + Yambo	1	0.60
Yambo	10	6.20
Total respondents	161	100%

Tractors hours per Ha.

1-2.5 hrs	11	7.5
3 hrs	102	68.0
3.3-4	37	24.5
Total respondents	150	100%

It was found that out the 326 farmers interviewed, 161 responded. Out of that 150 farmers (93.2%) said they use tractors for land preparation, 10 farmers (6.2%) said they use yambo alone, and only one farmer (0.6%) used the combination of tractor and yambo for land preparation.

The 150 farmers that said they used tractors for land preparation used different number of tractor hours per hector. The majority 68% used 3 hours/Ha, 24.5% of the farmers used 3.3-4 hours per Ha while only 7.5% used less then 3 hours/ha.

Usually the activity of land preparation takes only one operation e.g. plowing, and sometimes harrowing only.
So the number of tractor hours/ha depends on the kind of operation practiced and speed and power of tractor used.

6.2. Adoption on Fertilizer Use

In contrast with the result on awareness discussed previously in section 5.6, through the survey of the Food Security Project, it was found that the real adopters or users of fertilizers were only 12.3%, while the rest 87.7% did not use fertilizers (table 13).

It was also found that 94.7% of the fertilizer users used urea while only 5.3% used NPK. The dosage of fertilizer application per hector varied, the range varying from 5-100Kg/ha, with the majority (58%) using 50 Kg/ha.

To make a farther analysis on the adoption of fertilizer use on maize crop a comparative study was made. The findings of the Food Security Project in 1986/87 were compared to the study of Boateng, Yusuf and David of 1984/85 (see table 14).

It was found that the number of farmers using fertilizer on maize production in 1984/85 were 20.5% while in 1986/87 the number went down to 12.3%. That shows a drop in use of fertilizers on maize production and probably on all crops. Also the number of applications changed gradually. That means more farmers went from the practice of two times application back to one time application.

From table 14, you see that in 1984/85 40% of the farmers in the Shabelle regions practiced two times applications, while in 1986/87 that number fell down to 37%. That effect might be explained as follows.

- In 1984/85 some of the farmers were still using imported and cheaper fertilizers, so the consumers were more.
- In parallel with that the Urea Plant was established and produced enough urea for the market in 1984/85.
- But in 1986/87, the main supplier of fertilizer (the Urea Industry) was broken and no fertilizer was imported, thus inadequate supply of fertilizer in the country.
- Also the available fertilizer in the black market, the prices went up and many farmers couldn't afford to buy it.
- This data of Food Security Project of 1986/87 was gathered in Der 1986 which was very dry and many farmers did not grow the maize crop, thus less use of fertilizers during the survey time.

Table 13

Adoption of fertilizer use on maize by small farmers in Lower and Middle Shabelle in 1987

Farmers Answer		# of farmers	Percentage %
No		135	87.7
Yes		19	12.3
Total		154	100%
Types of fertilizer	Urea	18	94.7
	NPK	1	5.3
	Total	19	100%
# of application	1 time	12	63
	2 times	7	37
	Total	19	100%
Amount applied to the hectare	5 kg/ha	1	5.25
	20 kg/ha	1	5.25
	50 kg/ha	11	57.90
	100 kg/ha	6	31.60
	Total	19	100%

Table 14

Comparative study of 1984/85 and 1986/87 on fertilizer use on maize by small farmers in Lower & Middle Shabelle

Farmers	1984/85	1986/87
Using fertilizers	20.5%	12.3%
Not using fertilizers	79.5	87.7%
Total	100%	100%
Apply two times	40%	37%
Apply one time	60%	63%
Total	100%	100%

1984/85 Range of amount used : 66 - 168 kg/ha
1986/87 Range of amount used : 5 - 100 kg/ha.

7. Constraints and Suggested Strategies

In this section we will lock into the constraints that are causing major reduction in farmers production. The discussion in this paper is mainly focussed on the prenarvest related problems divided into five major areas, namely Machinery and Fuel, Improved Seed, Agro-chemicals, Irrigation and Weed.

7.1. Machinery & Fuel Problems

In this constraint, there are two factors to be considered: (a) Tractor hours and (b) Fuel availability.

(a) Tractor Hours

Availability on time is usually a constraint. In the survey of the Food Security Project is was found that only about 5% of the farmers have tractors. The rest either rent it from private or from public such as ONAT.

Due to the high demand for tractor services and low efficiency of operations many farmers and up in not preparing their fields at the right time.

During the rush time for the tractor services, just before the Gu' season starts, the price per tractor hour shoots up, some farmers can't even afford it without getting credit.

(b) Fuel Shortages

Is also another problem. For the last several years big fuel shortages have accrued during land preparation times and some to extent during high demand for irrigation. On the other hand no effective contingency plan and policy was developed. Not learning from the previous mistakes is repeated again and again.

Suggested Strategies

(1) Organize Farmers Groups

The problem of tractor hours availability could be reduced by organizing farmers in to groups of cooperatives or villages groups. This way farmers pool their needs together and thus they can utilize services (tractor, credit, extension) more efficiently.

(2) Train ONAT Field Staff

To reduce the problem of ONAT technicians and drivers not doing an efficient job, an appropriate periodical training should be offered to them.

(3) Allocate Fuel for Agriculture

To reduce the problems of fuel shortages, two things could be done:

i) Dye Agriculture fuel by giving special color to the diesel allocated for use in agriculture, and stopping it from the non agriculture uses.

ii) Conserving a buffer stock for the contingency purposes for agriculture.

7.2. Improved Seed Problems

The most important improved seed at a wider use so far is the Somtux maize seed. The major constraint in this is the short supply of the seed itself and the other inputs required with it such fertilizer, pesticides etc.

The major supplier being the Seed Multiplication Farm in Afgoi plus some contract growers of the certified seed (Darsalam farmers), the quantity produced is not enough to cover the farmers demand for it.

In different studies and surveys made through the regions of Middle & Lower Shabelle, it was found that only about 30 percent of the farmers use improved seed (maize), the rest (70%) use local varieties. At present, also only about 7% of the farmers are getting improved seed through credit.

Suggested Strategies

(1)- Through intensive research bring other alternatives of improved seed to select from (produce more potential varieties besides Somtux).
(2)- Increase production of the present variety (Somtux) through establishing a National Institution for Seed Production supported by a strong programme of certified seed production.
(3)- Increase the volume and coverage of the small farmers credit programme.

7.3. Agro-chemical Acquisition & Distribution Problems

The complete or partial in availability of inputs have reduced farmers adoption of extension recommendations. The issue could be under three main problems: Hard currency problems, Urea Factory problems and input distribution problems.

(a) Hard Currency Problems

Like most of the developing nations, Somalia had always had hard currency problems for use of input imports. But the ASAP money of 70 million U.S. dollars for use of agriculture inputs imports were provided by the World Bank. This money is sold by the Central Bank of Somalia by auction at fortnight intervals.

Unfortunately, it was found that about 71% of it is used for food imports rather then agriculture inputs. Thus inadequate supply of inputs has become a big constraint to agriculture production.

(b) Urea Factory Problems

Due to the technical and economical problems of the Urea Industry and its frequent break downs, the fertilizer (urea) availability have become very insecure. Also during that period, no imports were allowed, and no buffer stock was conserved.

Thus no reliability on either imports or internal production of the input and has become a limiting factor to crop production.

(c) Distribution problems

Lack of adequate distribution channels and properpricing policies have farther complicated the input use. Even when inputs are available in the country, these are found in storage facilities in the bigger cities (such as Mogadishu, Kismayo or Berbera) away from the reach of the reach of the small farmers.

Also lack of timely and proper price information for the farmers is another problem. All those factors have hindered farmers from high adoption of extension recommendations.

Suggested of Strategies

(1) Use of Auction Money

Redirecting the use of the ASAP money is necessary. Funds for procuring fertilizers and other inputs that have to be imported could be obtained from the World Bank money auctioned by the Central Bank of Somalia.

(2) Conserve a Buffer Stock

Whether the Urea Factory is operating or not, develop a national policy of conserving a buffer stock of agricultural inputs for contingency reasons.

Depending on the nature of input, the buffer should be about 25% of the country's estimated annual demand of urea & other necessary inputs

(3) Reorganize ADC

Work out a suitable credit facilities & sound funding arrangements for ADC. Reorganize ADC, and utilize its present facilities (storage and transport) for stocking & distributing inputs from national to regional or district levels. (If necessary make farther arrangement with ENC to utilize its empty storage facilities).

(4) Organize Retail Groups

At the input retail level, organize multipurpose cooperatives, private input dealers or farmers groups so that handling cost of inputs becomes reasonable.

(5) Identify Training Needs

Organize training on management and proper handling of agro-chemicals and other inputs for all levels (from national to village level).

(6) Establish a Coordination Board

Establish a National Agricultural inputs Board to coordinate the agricultural inputs distribution. This board will provide policy guide lines on:

(a) Inputs price policy including taxes and subsidies as related to farm prices.

(b) The allocation of investment funds (at all levels).

(c) Sources of supply (domestic or on the international market).

(d) Training needs (identify for all levels) and conduct national work shops on inputs related issues.

7.4. Irrigation Problems

(a) Bad Canals

Most of the farmers in the irrigated areas of the Shabelle valley interviewed said that the present major canals were inadequate. The canals were either filled with silt and weeds and or too small for the growing demand of farmers for irrigation water.

(b) Improper Land Levelling

This is also a big factor affecting the yields of most farmers. Due to this, fields con not be irrigated uniformly. Part of a field,crop may die with water landing and another part with moisture stress.
Therefore, no consistency of crop growth and good yields cannot be achieved.

(c) Lack of Drainage Systems

Due to the poor drainage of the heavy day soils in the irrigated areas of the Lower and Middle Shabelle regions, it was observed that flooding of fields after an intensive rain is very common. Thus crop yields are completely last of greatly affected.

Also, a continuous use of disc plows at a constant depth have probably created strong hard pane under the top soil, thus adding to the prominence of the drainage problem.

(1) Maintain Irrigation System

Periodical but regular cleaning of still and weeds from the primary and secondary canals is required. Also restructuring some of the major canals to fit the growing demand for irrigation water is necessary.

(2) Research on Effective Irrigation Methods

Since this is a very important factor affecting yields, a study on an intensive research on irrigation systems be conducted. Them extension teaching emphasize the recommendations on effective irrigation methods in the second period of AFMET project. The study and research findings and extension recommendations be.

(3) More Land Rehabilitation project

Also where it is feasible, introduce land rehabilitation projects (like the Bulo-Marerto Irrigation Project) to do the land levelling for the small farmers with heave government subsidies.

(4) Provide Drainage Systems

during land rehabilitation activities, drainage ditches must be dug along the fields to drain the excessive water from irrigation or heavy rains. Also heavy deep plow (or chiselling) from time to time to break down the hard pan under plowing green manures and continuous use of animal manure will amend the soil structure and in the long run improve the drainage condition of the soil.

7.5. Weed Problems

Weed has become a major limiting factor to crop production. It is a fact that in the irrigated areas, weeding alone takes over 40% of the cost of production. Weeds can also cause 100% loss of yields.

During a peak time of the growing season weeding labor usually becomes in shortage and expensive. At the same time over 95% of the fields are weeded by manual labor. The basic tool used is the hand hoe.

On the other hands, no adequate research findings is available on weed physiology and habit. Thus efficient control methods are not known.

(1) Study Alternative Methods of Weeding

Under take a study on the economies of alternative methods of weeding:

- Mechanized, semi-mechanized and manual labor.

(2) Test Animal Drawn Implements

Weeding with animal drawn implements is possible over the majority of soils even along the Shabelle valley. Thus launch a programer on animal traction including design of weeding implements and training of farmers and their livestock.

(3) Research on Local Weed

Establish an intensive research on weed science-specific to Somalia. This will include screening of the agro-chemicals (herbicides) and come up with specific recommendations to weed control.