Review of Sunflower Research in Ethiopia

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Abstract

Sunflower is one of the non-indigenous oilseeds in Ethiopia which ascertained to be adapted from 800 to 2400 m.a.s.l. and performs well under varying soil and climatic conditions of the country. This paper is, therefore, attempts to illustrate briefly the adaptation potentials and production requirements of sunflower in Ethiopia.

Breeding activities undertaken so far recommended three maturity groups (early: NSH-2, NSH-25; intermediate : Argentario, Improved Russian Black; and late varieties : Russian Black, Hesa, and Pop-158) for commercial production in Ethiopia.

June is found to be optimum planting time in most sunflower growing regions. Plant populations ranging from 44,000-53,000 and 53,000-88,000 plants/ha is optimum for late and early varieties, respectively. Little or no response were reported to fertilizer applications. Two hand weeding or application of herbicides (Alachlor and Pendimethalin) have shown sound control of weeds.

Seed dressing with Metalaxyl at the rate of 2.19g ai/kg of seed was found to be effective in controlling downy mildew, one of the major diseases, and June planting reduced its incidence. Recently, root-knot nematode is reported to affect sunflower production around Awasa areas and hybrid Super 530 showed certain level of resistance. African bollworm is the most serious insect pest in Ethiopia and the variety "Eliodoro" showed good tolerance.

Introduction

Sunflower (Helianthus annuus L.) ranks with soybean, rapeseed and groundnut as one of the four most important annual oil crops in the world (FICK 1989, SKORIC 1992). This is largely due to the efforts of plant breeders in improving seed yield, oil content and adaptability of the crop to a wide range of climatic conditions (HIRUY 1990). In Ethiopia, sunflower is one of the eight most important oil crops largely grown in Awasa (Southern) area and with a good production potential in Beles and Dedessa (North-Western) regions (HIRUY 1990, SOLOMON 1988, HAILE and MEKONEN 1993, HAILE 1994). Though the crop has high potential to become competent oil crop in other parts of the country, much progress was not achieved in the improvement program. This paper attempts to summarize past research activities and results obtained so far.

Breeding
Adaptation trials

The adaptation trial was conducted in various agro-ecological zones of the country to identify suitable areas for sunflower production. Based on the results of adaptation trial, HIRUY (1990), and HAILE and MEKONEN (1993) reported that sunflower in Ethiopia, is adapted to altitudes ranging from below 800 to above 2400 m.a.s.l. but highly suited to 1300 to 2600 m.a.s.l. It can be grown in a wide range of soil types with pH ranging from 5.5 to 8.0. Hence, its production can be extended to these areas to alleviate the oil shortage in the country.

Germplasm collection and evaluations

During the last ten years about 600-700 germplasm collections were imported from different countries (USA, Russia, Canada, Yugoslavia, Romania and Italy) through the International Research Development Center (IDRC) of Canada and being evaluated at different locations. Additionally, some local collections were made in early 1980's. Promising and high yielding introductions were maintained and tested under multilocational trials for further selection. Most advanced materials were classified as medium to late maturing types with high oil content. However, most of the materials were lost due to improper handling that resulted from lack of knowledge of the breeding approaches in sunflower (HAILE and MEKONEN 1993). The desired materials can be obtained from the original suppliers and the evaluation works can be continued if the problem of skilled man power in the field of sunflower breeding is alleviated.

Varietal development

The Sunflower Improvement Program in Ethiopia was started in the late 1960s with the main objective of developing productive, oil rich varieties having stable performance under different ecological conditions of the country. Since then, three varieties, viz., Russian Black, Hesa and Pop-158 were released. These varieties are late maturing types often faced moisture stress or damaged by frost before they mature (HIRUY 1990). In 1989/90, two early varieties; namely, N.S.H-2 and N.S.H-25, and two other intermediate types: Argentario and Improved Russian Black, have been identified from mass and recurrent selection programs as better performing varieties and advanced to verification level for release (ALEMU and SOLOMON 1990, HIRUY 1990). However, the release of these varieties was suspended for the fact they did not meet the requirements of the National Variety Release Committee of Ethiopia.

Agronomy

One of the major bottle neck factors limiting sunflower production is inappropriate agronomic practices. Agronomic research activities undertaken to tackle the problem are reviewed below.

Planting date and density

In sowing date trials conducted at Awasa, Arsi-Negelle and Bako higher yields of sunflower varieties was obtained when it is sown in

June than in July or August (HIRUY 1990, SOLOMON 1988, TENAW 1990). The studies on plant population revealed that 44 000–53 000 plants ha^{-1} with respective inter- and intra-spacing of 75 and 25 cm was found to be optimum for late maturing varieties while 53 000–88 000 plants ha^{-1} was optimum for early varieties. However, TENAW (1990) reported that there were no significant differences in higher and lower density plantings at Awasa and it was suggested to be so due to compensation effects.

Weed control

A variety of weeds including Polygonum nepalense, Galinsoga parviflora, Nicandra physalodes, Tagetus minuta, Plantago lanceolata and Amaranthus hybridus were reported to be the most dominant weeds in sunflower fields in Ethiopia. Yield reduction due to weeds was reported to be about 58% (TENAW and BEYENESH 1992) and weeds were reported significantly to affect head and stem diameters, plant stand and lodging (TENAW 1991). Two hand weedings with more emphases at seedling stage, were found to be optimum in controlling weeds. Two chemicals, viz., Alachlor at 5 kg product/ha and Pendimethalin at 3 kg product/ha gave sound control of weeds in sunflower (BEYENESH and TENAW 1992, HIRUY 1990).

Fertilizer applications

The multilocational trials were conducted both with and with out fertilizers since 1980s. Most of the trials showed no response to fertilizer application. The results of fertilizer trials conducted in sunflower production fields at Awasa, Herero and Sheneka indicated that there were no response to nitrogen and phosphate fertilizer applications. However, it was suggested to start application as the need arises.

Crop protection

Major diseases and their control

Downy mildew (Plasmophora halstedii), stem and head rot (Sclerotinia sclerotium), rust (Puccinia helianthi) and leaf blight (Fusarium equisetii and Sclerotinia spp.) are the most prevalent diseases of sunflower in Ethiopia (TEKLEMARIAM et al. 1985). A part of local collections and introductions has been screened for downy mildew resistance and some of the introductions appeared to possess high level of resistance. Metalaxyl at the rate of 2.19g ai/kg seed was found to be effective in controlling downy mildew. Among the cultural practices, June sowing reduced its incidence (TEKLEMARIAM et al. 1985, HIRUY 1990). In recent years, root-knot nematode (Meliodogyne spp) is reported to affect hybrid sunflower production around Awasa areas. Certain hybrids were screened for root-knot nematode and the hybrid Super 530 was found to show certain level of resistance (MESFIN 1992).

Major insect pests and their control

Among 28 insect pests recorded to be associated with sunflower, African bollworm is the most serious insect pest in Ethiopia. A range of varieties have been screened for resistance to this insect

pest and the variety "Eliodoro" showed certain level of tolerance against African bollworm (HIRUY 1988).

Summary

Regardless of these efforts made by the sunflower research team, the yield of sunflower in Ethiopia remained low due to lack of high yielding and adaptable varieties, sub-optimal agronomic practices, and prevalence of disease and insect pests. The problem of low yields can be tackled by developing high yielding varieties through introduction and selection from genetically diverse sources of germplasm or through hybridization of different lines followed by selection, in fact through continuous efforts. To facilitate this, the establishment of superior parental stocks is a prerequisite. Moreover, development of synthetic varieties from the wider genetic base materials should be considered since they are superior to other types. Further identifications and tackling of major constrains (management practices and diseases) limiting sunflower production, such as investigation of effect of crop rotation on diseases, insects and weeds, assessing effect of moisture stress, devising integrated diseases and weed control methods in Ethiopia should also be considered.

Table 1. Summary of sunflower research activities undertaken in Ethiopia, 1980s–1995.

Activity	Result obtained	Duration	Applicability	Drawback of the result
1.Breeding				
1.1 Adaptation trial	Potential areas identified	1980s	Wider range	Some are non-sunflower growing areas
	Altitude 1300-2400m 2400-2600m Soils: Wide range Soil pH :5.5-8.0			
1.2 Germplasm Evaluation	600-700 entries evaluated	1980s-1993		Most of the materials were lost
1.3 Varietal Development	Varieties were developed			
	-Russian Black, Hesa & Pop-158 were released	1976	Wider range	Only Russian Black cultivated
	-NBH-2 & -25, Argentario & Improved R.B. verified	1990	Wider range	All were not released due to lack of uniformity
2. Agronmy				
2.1 Sowing date	-Planting in June was Recommended	1980s & 1990	Awasa; Arsi-Negelle & Bako	
2.2 Plant density	a. 44 000-53 0000 &	1980s	Wider range	
	b. 53000-88000 Plants/ha	1980s		
2.3 Weed survey	-Major weed identified	1980s	In most sunflower growing areas	
2.4 Loss assessment	-58% loss detected	1980s	Awasa areas	
2.5 Weed control	-Two hand weeding &	"	same	
	Alachlor (5 kg product/ha)	"	same	
	Pendimethalin (3 kg Product/ha) recommended	"	same	
2.6 Fertilizers	-No Need of fertilizers	1980s	In most Sunflower growing areas	
3. Crop protection				
3.1 Disease survey	Major diseases identified	1980s & 1990s	In most sunflower growing areas	
3.2 Control method	-June planting for downy mildew Control	"	Awasa areas	
	-Metalaxyl (2.19ai/ha)	"	same	
	-Some resistant entries were observed	"	same	
	-Resistant hybrid found for root-knot nematode	1990	Wider range	
3.4 Insect pest survey	-Major pests identified	1980s	Awasa areas	
3.5 Control Method	-Variety "Eliodoro" tolerance to African bollworm	1980s	Wider range	

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Acknowledgement
The authors would like to acknowledge the International Development Research Center (IDRC) of canada for the financial support of this project.