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Evaluation of Potential Trap Crops on *Orobanche* Soil Seed Bank and Tomato Yield in the Central Rift Valley of Ethiopia

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Abstract: A field experiment was carried out with selected crop on a naturally *Orobanche* infested soil to test the potential of this crop in *Orobanche* seed bank exhaustion preciding tomato field at Melkassa Agricultural Research Center, Merti Upper Awash Agro-Industrial Enterprise and Ziway Horticulture Development Enterprise in 2002 and 2003. In the third season all plots were planted with tomato host plant to see the cumulative effect of trap crops to deplete soil seed bank of *O. ramosa* and *O. cernua.* Maize and snap bean showed better performance in stimulating germination of *Orobanche* seed bank and raised the germination by 74 and 71%, respectively. Maize and Snap bean were also complement each other under inter-cropping and soil seed bank of *O. ramosa* and *O. cernua* was depleted by 72.5% per season. Yield of tomato was significantly increased due to the reduction of *Orobanche* seed band in the 3rd season (2004).

Key words: *Orobanche ramosa* and *Orobanche cernua* · infested soil

INTRODUCTION

Orobanche ramosa and *Orobanche cernua* have become increasing problem of tomato production in the Central Rift Valley of Ethiopia, mainly state owned farms like, the Upper Awash Agro-Industrial Enterprise at Merti tomato canning factory have faced production constraint due to *Orobanche ramosa* and *O. cernua.* Currently, there is no consistent and sustainable method for the control of *Orobanche* elsewhere in the World [1]. However, some authors suggested trap crops as sustainable and useful method for the control of *Orobanche* species [2, 3]. It is one of the most economical methods of controlling *Orobanche* parasitic weed in tomato [4]. The effect of trap crops on parasite play great role in stimulating seed germination but do not attacked themselves by the parasites. Some research work was available on trap crop as control method against *Orobnche* parasitic weed of tomato [5], but the biology and ecology of non-host plant has to be studied in relation to *Orobanche* parasitism [6 - 9]. Each trap crop control at least one *Orobanche* species but not all recommended trap crop control all *Orobanche* spp. [10]. Crop rotation with potential trap crops for number years say 5-10 years deplete soil seed bank of *Orobanche* infestation *Orobanche* parasitic weeds assumed to be reduced by 30% in every growing season, growing trap crops for two consecutive seasons reduce soil seed bank of *Orobanche* species by 60% [11 - 14].

Therefore, this experiment was conducted to evaluate the potential of different crops for their ability to stimulate *Orobanche* germination to exuast the seed bank and reduce infestation of the main crop.

MATERIALS AND METHODS

Ten potential trap crops were identified as treatments from different crop families, these were: Fenugreek (*Tregonella foecum graecum*), Linseed / Flax (*Linum usitatissimum*), Alfalfa *(Lucern*), Cotton (*Gossipium* spp), Onion (*Allium* spp), Garlic (Allium sativum), Pepper (*Capsicum annum*), Snap bean (*Phaseolus vulgar*), Maize (*Zea-may*), Sesame (*Sesamum indica)*, Tomato *(Lycopersicum esculentum*) as a (Check).

The ten Trap crops and check tomato were arranged randomly in three replications and it was conducted for two years (2002 and 2003). Susceptible tomato variety (Roma vf) was planted to detect depletion of soil seed

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bank of *Orobanche* spp in the 3rd year (2004), in all trial sites (Melkassa Agricultural Research Center, Ziway Horticultural Development Enterprise and Merti Upper Awash Agro-Industrial Enterprise).

Design of the experiment was RCBD, with three replications with plot size of 6 m x 6 m = 36 m^2. Fertilizer application for the trap crops was 100 kg ha^{-1} DAP and Urea 50 kg ha^{-1} at planting. Application of fertilizer for tomato 100 kg ha^{-1} DAP at planting and Urea 50 kg ha^{-1} as split (3rd weeks after transplanting, flowering and fruit setting stages of tomato). Data was analyzed using SAS software [15].

RESULTS AND DISCUSSION

The *Orobanche* shoot count was significantly reduced for trap crop planted plot than the check (Table 1 and Fig. 2) and tomato yield was increased (Table 1 and Fig. 1) as a result of reduction of *Orobanche* shoot count.

Among experimented potential trap crops, Maize (*Zea-may)* and Snap bean (*Phaseolus vulgare*) showed very remarkable reduction on soil seed bank of *O. ramosa* and *O. cernua* by 74 and 71%, respectively. The other rest potential trap crops also performed well in reduction of soil seed bank of *O. ramosa* and *O. cernua* more than 60%. Maize and Snap bean are frequently intercropped by small farmers in the same field which attributed high benefit in reducing of soil seed bank of *Orobanche* on average 60-65% per season / field can be attained (Table1). Potential trap crops may be the cheapest means of controlling *Orobanche* parasitic weeds in tomato production.

Table 1 trap crops listed have already proved additional advantage for the farmer by consuming grain harvested from trap crops planted to exhaust soil seed bank of *Orobanche* parasite and better tomato yield was also harvested because of lesser infestation *Orobanche*. Thus, Optimum control of parasitic weeds by means of trap crops is by far the most economical method to be

Table 1: Potential trap crops used in the year 2002 and 2003 and *O. ramose* and *O. cernua mean* Shoot count/plot and Mean tomato (Roma-vf) in 2004 yield at three locations

Trap crops	Reduction of *O. romosa* and *O. cernua (*%)	Locations (Shoot count / plot)			Mean shoot count / plot	Mean yield (kg ha^{-1})
		Melkasa	Zeway	Merti		
Fenugreek	63	87	89	92	89	61000
Linseed	67	78	80	84	81	67000
Alfalfa	70	76	69	75	73	74000
Cotton	66	77	84	86	82	66000
Garlic	69	75	74	76	75	70500
Onion	70	87	73	59	73	75000
Pepper	67	88	79	75	81	66000
Snap bean	71	66	76	70	71	78000
Maize	74	60	62	63	62	85000
Sesame	64	90	79	88	86	62200
Tomato (Check)	-	145	235	215	198	42000
CV (%)		10.2	14.3	10.6	11.7	17.48
LSD at 0.05		21*	19.5*	15.6*	26.2*	245*

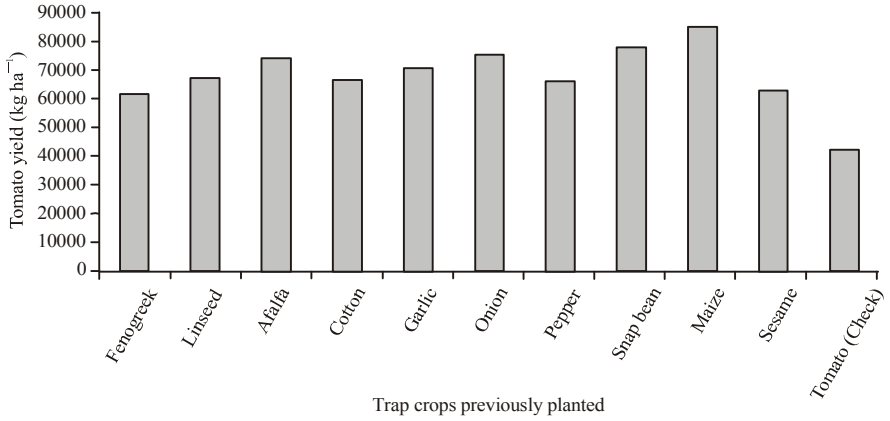

Fig. 1: Mean yield of tomato (kg ha^{-1}) obtained in 2004 at three locations after different trap crop planted in two sucessive years (2002 and 2003)

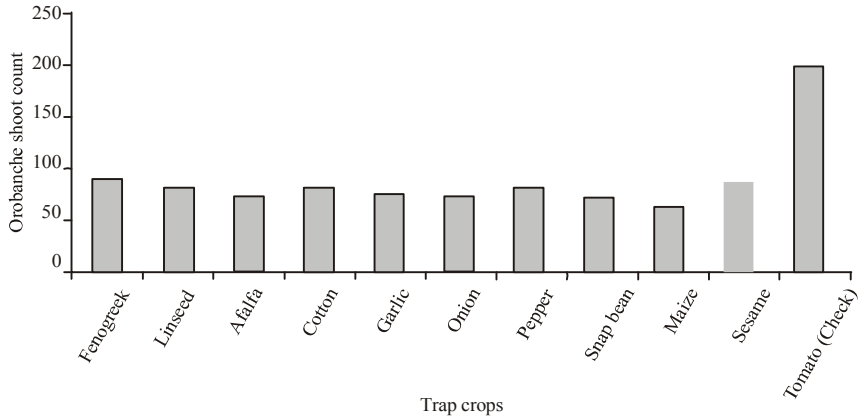

Fig. 2: Mean *Orobanche* shoot count after diifernt trap crops in the previos sucessive years

practiced by small-scale commercial farmers of vegetable growers in the Central Rift Valley of Ethiopia. Similarly, Trap crops like Maize and Snap-bean have confirmed similar results with the work of Labrada and Perez [3] in Cuba to control *Orobanche* cernua in Tobacco plant and further possibilities of trap crops and catch crops for the control of parasitic weed seeds in Germany [8]. Vegetable producers like that of Ziway and Merti Enterprises in the Rift Valley of Ethiopia have sorted practicing trap crops as to control pests in their farm and they found it very economical compared to pesticides in general. Currently, it is recommended small scale or large-scale commercial vegetable growing farmers to use trap crops as means of controlling *Orobanche* parasitic weeds in tomato. Trap crops in general have shown their potential to control *Orobanche* as it has been previously done by Sauerborn *et al.* [9].

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