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Evaluation of Herbicides for the Control of Turmeric Weeds at Teppi, Southwestern Ethiopia

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ABSTRACT

Turmeric (Curcuma longa) which belongs to the family (Zingiberaceae) is one of the major exported spice in Ethiopia. In the world there are 30,000 weed species, out of these 18,000 species cause damage to the crop. Of the total annual loss of agricultural produce from various pests, weeds account for 45%. The experiment was conducted during the year 2016 at Teppi National Spices Research Center with the objective to evaluate registered herbicides for their efficiency of turmeric weed control. The experiment was designed in RCBD with three replications. Six treatments were used:-Fenopax + hand weeding, Fenopax + 2-4,D , 2-4,D + hand weeding, Fenopax, 2-4,D, Glyphosatewas used as the treatment with weed free check plot and un weeded control.The lowest weed density was observed on check plot (always free of weeds) and the highest weed density was recorded on control plot (un weeded). Leaf width and number of tiller per plant is the least and plant height and leaf length is the highest for control plot. The highest yield was recorded on check plot and the least was recorded on control plot. There was 70% yield reduction in control plot as compared to check plot. Greater than 30% phytotoxic effect was recorded for the herbicides Glyphosate and Fenopax. The application of 2, 4-D has no phytotoxicity on turmeric. Even if the check gives high yield than the other treatment, 2,4-D + two times hand weeding can be used as an option to control turmeric weeds. The cost benefit analysis and the application of pre-emergence herbicide must be done in the future for alternative chemical herbicide use.

Keywords: *Turmeric, Herbicide, Weed, Yield, Teppi*

INTRODUCTION

Weeds are the most underestimated pest in tropical agriculture, but they have influenced human activities more than other crop pests. Although crop yield losses from weeds vary from crop to crop and from region to region, because of various biotic and abiotic factors, it has been estimated that weeds cause a yield loss of about 10% in the less developed countries and 25% in the least developed countries (Akobundu, 1987). There is no detailed information available about the amount of crop yield losses due to weeds in Ethiopia.

Turmeric (*Curcuma longa*) which belongs to the family (Zingiberaceae) is one of exported spice in Ethiopia. In Southwest Ethiopia turmeric is produced as a cash crop and the lively hood of the area is depending on it. According to Habetewold *et al*. (2014), from the weed survey fields of turmeric a total of 27 weed species were identified. The most important families according to the number of represented species were Poaceae, Asteraceae and Amaranthaceae. The frequency of occurrence of individual weed species ranged from 1.25% to 58.75%, while the infestation level ranged from 0.04% up to 21.99%. The most frequent weed was *Sidaalba* were as the most dominant weed was *Galinsoga parviflora*. This two species contributed up to 37.6% of the infestation of weed in Turmeric field at south western Ethiopia.

In the world there are 30,000 weed species, out of these 18,000 species cause damage to the crop. Of the total annual loss of agricultural produce from various pests in India, weeds account for 45%, Insects 30%, Disease 20% and others 5%. Since fast growing nature of the weeds and shortage and expensive labor in the area make weed control difficult, weed control by means of chemical means is important and it is one component of integrated weed management. Therefore this trial was conducted for screening of effective, environmental and less cost chemical herbicides control mechanism in the area.

MATERIALS AND METHODS

Description of the Study Area

Teppi national spices research center is located at south western Ethiopia at $35^{0}08'$ longitude and $7^{0}08'$ latitude and at an altitude of 1200 m.a.s.l. It is situated at about 600km from the capital city (Addis Ababa) of Ethiopia. The annual average rainfall of the area is 1630 mm and the mean minimum and maximum temperature of the area are 15^{0}C and 30^{0}C respectively.

Experimental Material and Design

The turmeric variety Dame was used in the study. One broad leaf (2, 4-D at 0.72kg/ha), one narrow leaf selective herbicide (Fenopax at 1kg/ha) and one non selective herbicide (Glyphosate at 0.75kg/ha), Check (Clean weeding) and Control (un weeded)was used to test on major turmeric weeds at Teppi, south western Ethiopia. The experiment was planted in RCBD with three replications at Teppi National Spices Research Center during the year 2016 and exposed to natural weed infestation. The plot size was 1.8*1.65 (2.97m2). Planting was done at first week of April. Herbicides were applied using knapsack sprayer. The herbicides was applied during the critical stage of weed competition (When the turmeric was at the 4-leaf stage of growth, and major weeds such as poaceae, Asteraceae and Amaranthaceae, as well as the most frequent weed Sida alba and the most dominant weed Galinsoga parviflora reaches 4 to 5 leaf stage). Crop toxicity rate was recorded visually using 1-5 scale range at 7, 14 and 21 DAT for the herbicides treatments. Acceptable weed control was measured as better than 80% control and acceptable crop safety was measured as less than 30% injury.

Data Collection

Vegetative parameters (PH, NTPP, LL, LW and LPT), Yield parameters (RL, RW, NSFPP, NPFPP and Yield in KG/Plot) and Weed density, Weed Biomass and Weed control efficiency was recorded.

Weed control efficiency was calculated according to Chinnusamy N. et al 2013 procedure.

$$WCE = \frac{WBMC - WBMT}{WBMC} \times 100$$

Where WCE= Weed control efficiency in %, WBMC= Weed biomass in control plot, WBMT=Weed biomass in treated plot

Data Analysis

All the data's were collected and subjected to SAS version 9.0 software for analysis and LSD at 0.05 was used for mean separation.

RESULTS AND DISCUSSIONS

Effect of Different Weed Management Practices on Weed Density, Weed Biomass and Weed Control Efficiency

There is a significant difference among treatments. The lowest weed density was observed on check plot (always free of weeds) and the highest weed density was recorded on control plot (unweeded) (Table 1).This finding is in line with the result of Asmare et al. 2016. Fenopax is the least and check plot is the highest in weed control efficiency. Weed dry biomass was highly affected by herbicide treatments which are in line with the findings of Sathiyavani Erulan and N.K. Prabhakaran, 2015.

The Effect of Herbicide Treatments on Vegetative Parameters of Turmeric

There is no significant difference between leaf width among different treatments. Leaf width and number of tiller per plant is the least and plant height and leaf length is the highest for control plot **(Table 2).**

Table1. *Weed control efficiency of different weed management practices*

Treatments	Weed density in number/m^2	Weed Biomass in g/m^2	Weed Control Efficiency (WCE) in %
Fenopax	461b	1262b	44
2,4-D + hand weeding	111e	467e	79
Fenopax + hand weeding	190d	689d	69.5
2,4-D	218c	952c	57.8
Glyphosate 360	96f	488f	78.4
Check	78h	274h	87.9
2,4-D + Fenopax	92g	472g	79.1
Control	762a	2258a	-
CV%	**18**	**23**	
LSD	**11**	**34**	

Table2. *Vegetative Parameters*

Treatments	PH	NTPP	LL	LW	LPT
Fenopax	61.27b	4.3b	29.8b	10.27a	6.27ba
2,4-D + hand weeding	63ba	5.07ba	29.17b	10.27a	6.4ba
Fenopax + hand weeding	59.4b	4.4b	32ba	9.97a	6.57ba
2,4-D	56.5b	5.6a	31.6ba	10.2a	7a
Glyphosate 360	62ba	3.4c	31.47ba	10a	6.8ba
Check	58.7b	4.47b	30.27b	10.1a	6.4ba
2,4-D + Fenopax	57.87b	4.6b	28.13b	9.97a	6.4ba
Control	76.8a	2.87c	38.8a	7.67a	5.4b
CV%	**13.8**	**10.3**	**13.9**	**21**	**13**
LSD	**15**	**0.78**	**7.68**	**ns**	**1.49**

PH= Plant height, NTPP= Number of tiller per plant, LL= Leaf length, LW= Leaf width, LPT= Leaf per tiller

The Effect of Herbicide Treatments on Yield and Yield Component of Turmeric

There is a significant difference between check and the other treatments. The highest yield was recorded on check plot and the least was recorded on control plot. The same to this finding, B.B. Channappagoudar *et al*., 2013 also reported that maximum turmeric yield was recorded in weed free check. There was 70% yield reduction in control plot as compared to check plot **(Table 3).**

In line with this finding, Krishnamurthy and Ayyaswamy, 2000 was reported that the magnitude of yield loss varies from 30 to 75 per cent, depending upon the growth and persistence of weed density in the standing turmeric crop.

Table3. *Yield Parameters*

Treatments	Yield/plot (KG)	RW	RL	NSFPP	NPFPP
Fenopax	3.9c	11.4a	9.67a	10.4ba	3.2bc
Fenopax + hand weeding	3.9c	11.4a	10.37a	11.27ba	3.6ba
Glyphosate 360	3.87c	11.67a	9.3a	8.27b	3.4bc
2,4-D	4.0c	10.6ba	9.47a	12.8a	4.6a
2,4-D + hand weeding	5.29a	12.4a	9.2ba	11.67ba	4.2ba
2,4-D + Fenopax	4.47b	12.57a	10.37a	10.5ba	3.27bc
Check	5.7a	12.5a	10.8a	11ba	4.07ba
Control	1.7d	7.47b	7.5b	3.8c	2.4c
CV%	**6.17**	**16.8**	**10.45**	**20.3**	**18.9**
LSD	**0.44**	**3.3**	**1.75**	**3.5**	**1.19**

RW= Rhizome width, RL= Rhizome length, NSFPP= Number of secondary finger per plant, NPFPP= Number of primary finger per pla

CONCLUSION AND RECOMMENDATIONS

Turmeric (*Curcuma longa*) which belongs to the family (Zingiberaceae) is one of exported spice in Ethiopia. In the world there are 30,000 weed species, out of these 18,000 species cause damage to the crop. Of the total annual loss of agricultural produce from various pests in India, weeds account for 45%. Field trial was conducted during the year 2016 for screening of effective, environmental and less cost chemical herbicides to control turmeric weeds.

The experiment was designed in RCBD with three replications. Six chemical herbicides:- Fenopax + hand weeding, Fenopax + 2-4,D , 2,4-D + hand weeding, Fenopax, 2-4, D, Glyphosate was the chemicals used as the treatment with weed free control plot and un weeded check. The lowest weed density was observed on check plot (always free of weeds) and the highest weed density was recorded on control plot (un weeded). Leaf width and number of tiller per plant is the least and plant height and leaf length is the highest for control plot. The highest yield was recorded on check plot and the least was recorded on control plot.

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REFERENCES

[1] AKOBUNDU IO (1987) Weed Science in the Tropics. Principles and Practices. Wiley, Chicester, UK.

[2] Amare Fufa, Etagegnehu and G/Mariam, 2016. Weed Control Practices and Inter-Row Spacing Influences on Weed Density and Grain Yield of Finger Millet (Eleusine Coracana L. Gaertn) in the Central Rift Valley of Ethiopia. International Journal of Research in Agriculture and Forestry Volume 3, Issue 9, PP 1-7.

[3] B.B. Channappagoudar, S.S. Mane, Y.B. Naganagoudar, S.B. Channappagoudar, Santsha Rathod, 2013. Crop weed competition and chemical control of weeds in turmeric. Environment and Ecology 31 (2): 532-356.

[4] Chinnusamy N, Chinnagounder C, Krishnan PN. 2013. Evaluation of weed control efficacy and seed cotton yield in glyphosate tolerant transgenic cotton. American Journal of Plant Sciences 4:1159-1163.

[5] Krishnamurthy V.V. and Ayyaswamy, M., 2000, Effect of herbicides on yield of turmeric, Spice India, 13: 9-11

[6] Sathiyavani Erulan , N. K. Prabhakaran. 2015. Effect of Integrated Weed Management Practices on Plant Height, Number of Tillers in Turmeric during kharif Season. International Journal of Horticulture, 2015, Vol. 5, No. 2 doi: 10.5376//ijh.2015.05.0002

[7] T TAMADO & P MILBERG. 2000. Weed flora in arable fields of eastern Ethiopia with emphasis on the occurrence of Parthenium hysterophorus. Alemaya University, Ethiopia and Swedish University of Agricultural Sciences and LinkoÈping University, Sweden.

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