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Effect of Weed Management Methods on the Growth and yield of Ginger in Metu, Illubabor Ethiopia

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Abstract
A field experiment on ginger weed management was conducted at Metu from2009 and 2011 with the objective of identifying effective weed management for ginger under Metu condition. Different weed management methods were compared in a Randomized Complete Block Design with three replications. The treatments were: hand weeding at 30,60,90, days after planting, .hand weeding at 45,75,105,135 &165 days after planting, hand weeding at 60,90,120,& 150 days after planting, mulching at planting followed by hand weeding at 45 and 75 days after planting, . mulching at planting followed by hand weeding at 60 and 90 days after planting, hand weeding at 30 and60 days after planting followed by mulching followed by one hand weeding as needed, The result showed that the major weeds at both locations were: Cynodon spp., Cyprus spp., Digitaria spp., Gyzotia scabra, Bidens polynchyma, Nicandra physaloides, Commelina spp., Bidens pilosa, and Ageratum conyzoides. hand weeding at 30 and60 days after planting followed by mulching followed by one hand weeding as needed, hand weeding at 45 and 75 followed by mulching followed by one hand weeding as needed and weed free and weedy controls.The result reveled a highly significant ($p < 0.01$) difference between treatments The result showed that as weeding frequency increased yield of ginger also increased. One early hand weeding between 30 and 45 days was critical to secure high yield of ginger. Mulching at planting followed by two hand weeding at 60 and 90 days after planting gave higher yield compared with the clean weeding treatment. Similarly hand weeding at 30 and 60 days followed by mulching and followed by one hand weeding also gave similar yield with clean weeding. Mulching at planting enhanced early germination and growth of ginger compared with non mulched ginger. On the other hand, the result also showed that ginger was poorly competed with weeds that when the first hand weeding was delayed from 30 to 45 and 60 days after planting ginger growth was affected resulting in tremendous yield loss. The result also clearly showed that three hand weeding at 30,60 and 90 days after planting was not adequate under Metu condition. When weeding was totally ignored throughout the growing period yield reduction amounted 95.5 %.

Introduction

Ginger (Zingiber officinale Rose) is important spice crop which have been under cultivation since antiquity in Ethiopia. Ginger can be cultivated up to 2000 masl but the crop grows well in the hot humid and lowland areas of the southwest part of the country. Ginger is an important spice crop of the world .Its scientific name is *Zingiber officinale.*Its a valuable cash crop and plays an important role in aurvedic medicines in India .It has been used for cleaning body through perspiration, to calm down nausea,and to stimulate the appetite. Ginger tea is used as carminative and in the symptomatic treatment of colds. Ginger contains gingerol, an oleo resin that accounts for the characteristic aroma and therapeutic properties.Components of gingerol posses beneficial properties for the treatment of poor digestion,heart burn,vomiting and preventing motion sickness.

As the crop is slow germinating and growing yield loss as a result of weed competition is expected to be tremendous. The environmental condition of southwest Ethiopia is characterized by high temperature and high rainfall which is highly conducive for year round emergence and growth of highly competitive perennial and annual weed species such as *Cynodon spp., Cyprus spp., Digitaria spp./ Commelina spp., Bidens pilosa, Gyzotia scabra, and Ageratum conyzoides* (Tadesse et al,1998). In spite of the divers and highly competitive weed flora existing in the ginger growing areas, research information on weed management is not available for Metu area so far. Weeds cause reduction in crop yield and takes extra cost in the total labor use in crop production. Akobunda(1987) reported that weeds result in 65 % reduction in yield of root and tuber crops and takes 25% 0f total labor use in production. Weed competition has also been identified as a constraint to root and tuber production (Unamma,1984). At present farmers weed ginger late after the crop has been suffered weed competition or same times ginger fields may be left unwedded

The objective of the present study was therefore, to identify appropriate weed management methods for optimum growth and yield of ginger under Metu condition.

Material and Methods

The study was conducted on nitosols on naturally weed infested field at Metu sub center between 2010 to 2012 The study was laid out in randomized complete block design with three replications.

weed management treatments:
1. Hand weeding at 30,60,90, days after planting
2.Hand weeding at 45,75,105,135 &165 days after planting
3. Hand weeding at 60,90,120,& 150 days after planting
4. Mulching at planting followed by hand weeding at 45 and 75 days after planting
5. Mulching at planting followed by hand weeding at 60 and 90 days after planting
6. Hand weeding at 30 and60 days after planting followed by mulching followed by one hand weeding as needed
7. Hand weeding at 45 and 75 followed by mulching followed by one hand weeding as needed
8. . Weed free check
9 Weedy control

Weed species were visually observed and recorded throughout the study period. Weed biomass was determined by harvesting all weeds on the plots shortly before harvest. For final measurement the weed biomass was sundried until the weeds were well dried. Stand count, rhizome weight, rhizome length, number of tillers per plant and yield was recorded at harvest.

Yield loss (YL) was calculated using the following formula (Panda,2010)

$$YL = \frac{Y1 - Y2}{Y1} X100$$

Where YL= Yield loss, Y1 and Y2 represent yield of the clean weeding and other treatments, respectively

Weed control efficiency (WCE) using the following formula (Devasenapathy et al, 2008)

$$WCE = \frac{WDE - WDT}{WDC} X100$$

Where WDC= weed dry mass from the control plot (untreated), WDT= weed dry matter from treated plot

Growth parameters such as rhizome width, number of fingers per rhizome and rhizome Weight were recorded by selecting 5 rhizomes per treatment. In order to see the advantage of mulching at planting on early germination of ginger number of germinated ginger plants were counted at 30 days after planting by considering the whole plots.

All data were subjected to the analysis of variance (ANOVA) with the appropriate design as per Gomez and Gomez (1984) using SAS version 9.0 computer software program (SAS, 2002). Mean separation was performed when means were significant using Least Significant Difference (LSD) at 5 % and 1% level of probability

Results and Discussion

Weed Species

The major noxious and important weed species are presented in Tables 1. All noxious and important weed species were abundantly growing in the experimental site and the surrounding. The classification as noxious and important was based on the species competitive ability and time and many spent for their control. The noxious species are highly competitive for essential growth requirements such as nutrients, moisture and light and are also too difficult to control once they are established in the field.

Table1. List of the noxious and important weed species at Metu

Botanical name	Family	Growth nature	Ecophysiology definition	Economic importance
Cynodon spp	Poacea	Perennial	C4	Noxious
Cyperus spp	Poacea	Perennial	C4	Noxious
Digitaria spp	Poacea	Perennial	C4	Noxious
Gyzotia scabra	Asteracea	Annual	C3	Noxious
Nicandra physaloides	Solanacea	Annual	C3	Noxious
Bidens polunchyma	Compositea	Annual	C3	Noxious
Bidens pilosa	Compositea	Annual	C3	Important
Commelina benghalensis	Commelinacea	Annual	C3	Noxious
Ageratum conyzoides	Compositea	Annual	C3	Important
Plantago lanceolata	plantaginaceae	Annual	C3	Important

Ginger Germination (sprouting)

The result showed that ginger germination and emergence was highly influenced by mulching the crop at planting compared to non mulched ginger (Table 2). This might be because mulching has conserved ample moisture and regulated the temperature required for fast germination of the crop compared with none mulched ginger. This result has far reaching implication that the crop can grow and develop fast to compete fast growing

weed species in the field compared with non mulched ginger which in most instances is smothered by fast and vigorously growing weed species. On the other hand, rapid germination of ginger can also escape insect attack and also can be saved from erosion from heavy rains in the field. Maybe 2007 reported similar result that mulching ginger increased germination and growth of ginger plants in terms of height and number of tillers in the field and this was attributed due to the fact that mulching changed the physical and chemical environment of the soil underneath resulting in increased availability of phosphorus and potassium (Maybe et al, 2007). This same researcher also reported that weed growth in mulched plots was much less compared with none mulched ginger.

Table 2. Influence of weed management methods on number of germinated plants of ginger 30 days after planting at Jimma

Treatment	2010	2011	Mean
Weeding at 30,60,90,120,150 & 180 days after planting	20.0	30.3	25.2
Weeding at 45,75,105,135 &165 days after planting	18.0	22.3	20.2
Weeding at 60,90,120,& 150 days after planting	14.3	19.0	16.7
Mulching at planting followed by weeding at 45 and 75 days after planting	115.7	99.7	107.7
Mulching at planting followed by weeding at 60 and 90 days after planting	116.0	91.6	103.8
Weeding at 30 and60 days after planting followed by mulching followed by one hand weeding needed	17.0	21.0	19.0
Weeding at 45 and 75 followed by mulching followed by one hand weeding as needed	16.7	8.7	12.7
Clean weeding	18.3	27.7	23.0
Weedy control	12.0	9.7	10.9
CV %	21.9	25.6	
LSD 5%	9.8	11.1	
LSD 1%	13.3	14.7	

Rhizome weight, Rhizome length and number of fingers per rhizome

There was a highly significant (P<0.01) difference growth of ginger in terms of rhizome length, rhizome weight and number of fingers per rhizome between treatments (Table 3). As weeding intensity and frequency increased the rhizome length, rhizome weight and number of fingers per rhizome increased. The lowest rhizome length, rhizome weight and number of fingers per rhizome was recorded from the weedy control where the plots remained weedy throughout the growing period.

Table3. Effect of weed control methods on rhizome weight, rhizome length and number of tillers per rhizome at Metu

Treatment	Rhizome weight (gm)			Rhizome length (cm)			Number of fingers/rhizome		
	2010	2011	Mean	2010	2011	Mean	2010	2011	Mean
T1	12.1	13.7	12.9	17.4	6.2	11.8	14.6	14.7	14.7
T2	13.2	12.1	12.7	13.5	6.3	9.9	13.5	13.4	13.5
T3	11.9	12.7	12.3	11.1	6.3	8.7	13.6	12.5	8.7
T4	16.0	12.3	14.2	14.0	6.8	10.4	10.0	14.3	8.1
T5	13.3	12.1	12.7	14.8	6.9	10.9	18.1	12.4	10.2
T6	16.0	12.9	14.5	12.7	7.5	10.1	14.4	14.4	14.4
T7	15.4	12.0	13.7	13.4	6.3	9.9	14.8	12.7	13.8
T8	18.2	13.1	15.7	12.8	7.7	10.3	12.7	15.2	14.0
T9	2.0	1.5	1.8	3.4	2.5	2.7	1.6	2.1	1.9
CV%	31.1	10.8		20.4	20.6		13.5	17.4	
LSD 5%	4.9	1.5		1.1	1.5		2.0	2.6	
LSD !%	6.7	2.1		1.5	2.1		2.8	3.6	

Yield

There was a highly significant difference (p<0.1) between treatments (Table4). Ginger responded well for hand weeding that as hand weeding frequency increased yield of ginger also increased. The result showed that one early hand weeding at 30 days after planting was found to be critical under Jimma condition that yield was reduced by 15 % and 40 % compared with treatments where the first hand weeding was delayed up to 45 and 60 days, respectively (Table 4). However, the result also showed that by mulching ginger at planting the first hand weeding can be delayed up to 45 and 60 days after planting without yield being affected. This demonstrates that the crop suffers serious early weed competition leading to tremendous yield loss. By mulching at planting farmers can save ample time and can do other farm activities especially at busy times as the expense of weeding ginger.

The result also revealed that the frequency of hand weeding in ginger can be reduced by mulching at planting followed by two hand weeding at 45 and 75 days or by mulching at planting followed by two hand weeding at 60 and 90 days after planting. Similarly, the frequency of hand weeding can also be reduced by applying two hand weeding at 30 and 60 days followed by mulching and followed by one hand weeding. For example, the most frequently weeded treatments the first treatment with 6 hand weeding frequencies and the clean weeding treatment (hand weeded 8 times)where the crop was kept weed free throughout the growing period gave comparable yield compared with treatments 4,5,7 and8 with mean yield of 45.9, 44.1,42.0 and 43.3 quintal /ha.,respectively. The present study has clearly demonstrated that application of mulch was equally effective either at planting followed by hand weeding at 60 and 90 days or hand weeding at 45 and 75 days or mulching after two hand weeding at 30 and 60 days or at45 and 75 days after planting. Ginger was so poor competitor of weeds that when weeding was totally ignored yield reduction amounted 100%.

The present study has also showed the advantage of mulching ginger that the rhizome of mulched ginger plants was not exposed for direct sunlight which might seriously affect the quality of the crop as this was evident in none mulched ginger (data not shown).

Conclusion and recommendation

The present study has clearly demonstrated that ginger responded well for hand weeding that as weeding frequency increased yield of ginger also increased. As ginger is inherently low germinating and slow growing crop it suffers serious weed competition especially during early establishment period. The result showed that one early hand weeding at 30 days after planting was critical for high yield of ginger. If the first hand weeding is delayed up to 45 and 60 days yield was reduced tremendously. The present study also revealed that mulching ginger at planting and supplemented with two hand weeding at 60 and 90 and at 45 and 75 days after planting resulted in satisfactory weed control and comparable yield was obtained with the most frequently weeded treatment and the clean weeding. Similarly, Mulching ginger after two hand weeding applied at 30 and 60 days and also at 45 and 75 days after planting gave high and comparable yield compared with the clean weeding treatment. In general the present study has clearly demonstrated that mulching was found to be good agronomic practice for weed control and increasing ginger yield. Hence, mulching ginger at planting followed by two hand weeding at 60 and 90 days after planting or hand weeding ginger at 30 and 60 days followed by mulching or weeding ginger at 45 and 75 days after planting is recommended for good weed control and high yield of ginger under Metu condition.

Table 2.Yield of ginger as affected by weed management methods at Metu

Treatment	Weed dry weight kg/plot	Weed control efficiency	% yield loss	Yield Q/ha.			Mean
				2009	2010	2011	
Hand weeding at 30,60,90, days after planting	31.3	64.6	3.0	8.2	47.6	27.4	27.7
Hand weeding at 45,75,105,135 &165 days after planting	11.3	87.2	16.0	18.2	114.5	65.1	65.9
Mulching at planting followed by hand weeding at 45 and 75 days after planting	32.7	63.1	42.3	35.9	84.8	51.6	57.5
Hand weeding at 60,90,120 ,150 days after planting	43.3	51.0	7.6	7.3	33.7	20.7	20.6
Mulching at planting followed by hand weeding at 60 and 90 days after planting	12.7	85.6	11.3	28.7	131.5	78.6	79.6
Hand weeding at 30 and60 days after planting followed by mulching followed by one hand weeding as needed	7.7	91.3	15.5	26.9	103.7	63.7	64.8
Hand weeding at 45 and 75 followed by mulching followed by one hand weeding as needed	8.6	90.3	+1.7	24.6	115.8	72.3	70.9
Clean weeding	0.0	100.0	-	23.7	107.3	78.1	69.7
Weedy control	88.5	0.0	100.0	0.0	0.9	8.1	3.0
CV %	22.0			23.1	18.9	21.2	27.7
LSD 5%				9.3	27.9	15.5	
LSD 1%				14.5	38.3	24.3	

References

Akobundu.I.O.(1987).Weed Science in the tropics. Principles and practices. John Wily and Sons.London.522pp.

Devasenapathy P.T Remesh and B. Ganwar.2008. Efficiency indicies for Agriculture Management Resarch. New Indian Publishing Agency. New Delhi- India. Pp 57

Gomez. K.A. and A.A Gomez. 1984. Statistical Proceduers for Agricultural Research. Second edition, John Wiley and Sons Inc. Toronto. 680p

Maybe, E.V. and N.Miniray. 2007. Horticultural Science Series. Vol.5. New Indian Publishing Agency. Pitams Pura. New Delhi

Panda.S.C. 2010.Agronomy. Agrobios. India.833pp

SAS(Statistical Analysis System I nstitute. Inc.). 2002.Statistical Analysis System Software Version 9. SAS Institute Inc.,Cary, NC, USA

Tadesse Eshetu. 1994. Effect of Clipping Frequency of Couch grass (Digitaria abyssinica) on the Growth of young Coffee. In. Fassil Reda and D.G. Tanner (eds.) Arem Vol.2 and 3. Proceedings of the 2nd and 3rd Annual Conferences of the Ethiopian Weed Science Society. Addis Ababa, Ethiopia.

Unamma.C.P.A, Emyimmia.J. andEmezie.J.E.(1984). Critical period of weed interference in cocoyam/maize/sweret potato.Tropical Pest Management.31:21-23

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