Journal of Agriculture and Ecology Research International

20(3): 1-6, 2019; Article no.JAERI.53387
ISSN: 2394-1073

Determining Critical Weeding Period in Mungbean (*Vigna radiata* (L.) Wilczek) Under Rain Fed Condition in Western Tigray, Ethiopia

Goitom Teame[1*], Gebremedhin Gebregergs[1], Zerabruk Gebremedhin[1] and Darge Gramy[1]

[1]Crop Research Core Process, Humera Agricultural Research Center, Tigray Agricultural Research Institute, Humera, Ethiopia.

Authors' contributions

This work was carried out in collaboration among all authors. Author GT designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors GG and ZG managed the analyses of the study. Author DG managed the literature searches. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JAERI/2019/v20i330113
Editor(s):
(1) Dr. Gopal Krishan, National Institute of Hydrology, India.
Reviewers:
(1) Subrata Kumar Mandal, CSIR-Central Mechanical Engineering Research Institute, India.
(2) R. K. Mathukia, Junagadh Agricultural University, India.
(3) Fábio Henrique, Rural Federal University of Pernambuco (Universidade Federal Rural de Pernambuco), Brazil.
(4) Iwona Rybakowska, Medical University of Gdańsk, Poland.
Complete Peer review History: http://www.sdiarticle4.com/review-history/53387

Original Research Article

Received 15 October 2019
Accepted 18 December 2019
Published 02 January 2020

ABSTRACT

Mungbean (*Vigna radiata (L.) Wilczek*) belongs to the order of Fabales, Faboideae sub family and Fabaceae or Leguminosae family. The field experiment was carried out in 2014-2016 main growing seasons at Humera and Kebabo with the aim of determining critical weeding period. The experiment was conducted in RCBD design replicated three times and consists of 15 treatments. The crop was kept weed-free for the first 10, 20, 30, 40, 50 and 60 days after sowing and then remained weedy till harvest or kept weedy for the same periods and then remained weed- free till harvest. Weed free and weedy treatments till harvest were included as controls for comparison. Mungbean variety of Arkeb was sown at a distance of plant to plant 5 cm and row to row 40 cm and the plot area was 10 m^2. The combine analysis of three winter seasons revealed that unrestricted weed growth significantly reduce yield of mungbean by 52% compared to completely weed free.

**Corresponding author: E-mail: goitomyafenan@gmail.com;*

Mungbean seed yield increased when the duration of weed infestation period decreased. Yield components such as number of pods per plant didn't show significant difference, while number of seeds per pod and 100 seed weight shown significant difference. The critical weeding period for mungbean was 10-20 and 30-40 days after sowing.

Keywords: Critical period; weed competition; mungbean (Vigna radiata (L.) *Wilczek).*

1. INTRODUCTION

Mungbean (*Vigna radiata* (L.) Wilczek) belongs to the order of Fabales, Faboideae sub family and Fabaceae or Leguminosae family [1]. The annual production of mungbean in the globe reaches 6,814,403 tons from the area of 960,272 ha [2]. The total area coverage of green bean in Ethiopia is more than 15,379 ha with an average total production of 6,803tonnes [3].

Mungbean is a vital short duration, self-pollinated and diploid legume crop with high nutritive significances and nitrogen fixing capacity [4]. Its seed consists of 20-24% protein, 50-60% carbohydrate and other chemical compounds (flavonoids, phenolic acids, organic acids and lipids) [5]. Though this crop has numerous advantages its productivity is very poor due to lack of improved variety and inappropriate field management such as weeding. If weeds are not removed during the critical period a huge yield loss results as well as quality deterioration. Similar results were reports by Shuailb [6] and Dungarwal, et al. [7] as weed can reduce mungbean yield from 65.4% to 79.0%. Weed reduce yield in quality and quantity due to competition to nutrients, space, water etc. consequently, reduce the market value of the turnout [8]. The critical period for crop weed competition is the period from sowing up to which the crop has to get favorable environment (weed free) for best crop production [9]. Thus determining the critical weeding period is essential as basic information to take control weed.

2. MATERIALS AND METHODS

2.1 Area Description

The field experiment was carried out in 2014-2016 main growing seasons at Humera and Kebabo Western zone of Tigray Ethiopia. The dominant soil type of the area is chromic vertisol black in color which is characterized sticky during rain and cracked during dry season. According to Bahabelom [10], climate classification Western Tigray has a hot semi-arid climate. The annual rainfall ranges between 400 to 600 mm and most of the rain rains in June up to September. The annual mean temperature is 27.6ºC. It is also characterized by hot temperature, erratic rainfall, vast area of plain low lands suitable for large scale and subsistence agriculture including crops and livestock.

2.2 Experimental Site and Treatment

The experiment was carried out in 2014-2016 cropping seasons at Humera (Kafta Humera) and Kebabo (Tsegede) for three consecutive years (Fig. 1). The crop was kept weed-free for the first 10, 20, 30, 40, 50 and 60 days after crop sowing and then kept weedy till harvest and kept weedy for the same periods and then remained weed-free till harvest. Weed free and weedy treatments were included as check (Table 1).

The experimental design used was RCBD with three replications. The plot size was 10 m^2 and the net plot size was 6 m^2. Mungbean variety of Arkebe was used as testing material with spacing of 40 cm and 10 cm between row and plant, respectively. The field was plowed with disc harrow leveled uniformly and fertilized with DAP. Weeding practice was conducted based on the treatment nature manually.

2.3 Measurement and Measurement Methods

Agronomical data such as number of pods per plant, number of seeds per pod and hundred seed weight were recorded. Those parameters were counted from five randomly selected plants per plot. Mungbean seed yield of each plot was weighed in grams and converted to area basis to determine the yield in kg/ha.

2.4 Data Analysis

The data were analyzed using Genstat 17th edition to show the significant difference which was done by comparison of the mean with DMRT.

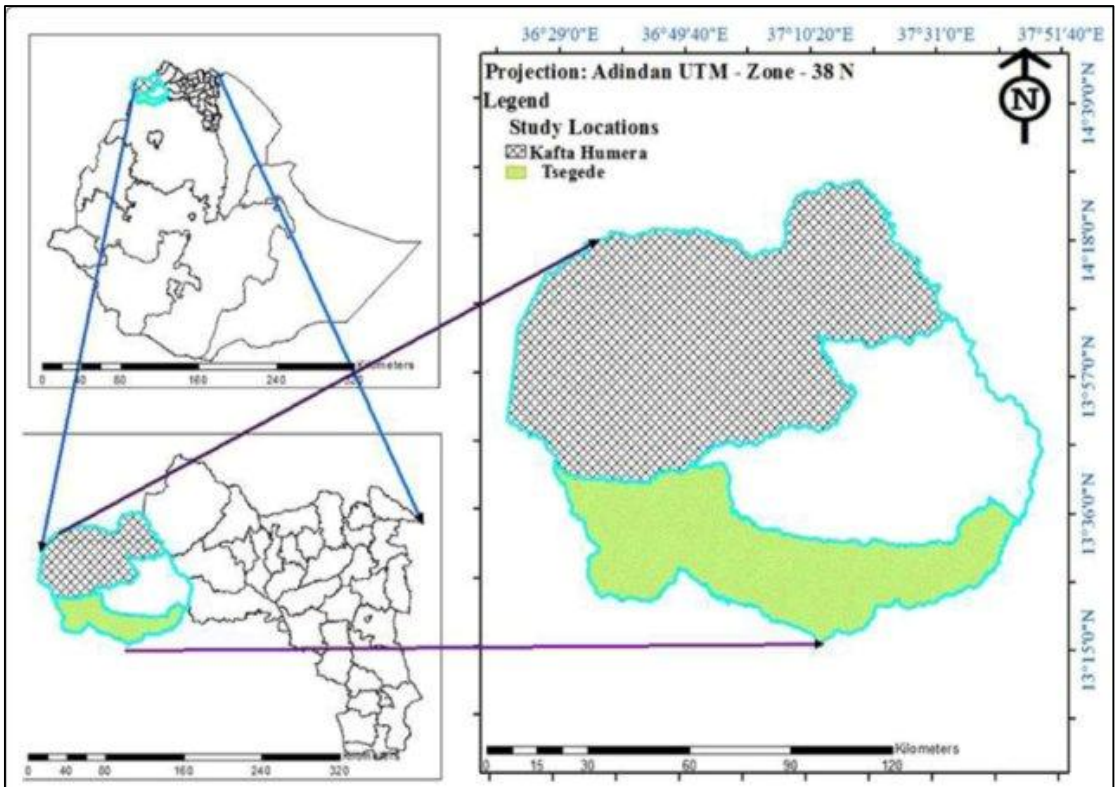

Fig. 1. Site map of the study area

Table 1. Treatment set up

Early competition (Treatment)	Late competition (Treatment)
Weedy up to 10 DAS	Weed free up to 10 DAS
Weedy up to 20 DAS	Weed free up to 20 DAS
Weedy up to 30 DAS	Weed free up to 30 DAS
Weedy up to 40 DAS	Weed free up to 40 DAS
Weedy up to 50 DAS	Weed free up to 50 DAS
Weedy up to 60 DAS	Weed free up to 60 DAS
Completely weed free	
Weedy check	
Farmers' practice	

3. RESULTS AND DISCUSSION

The different grassy and broad leaved weeds observed in association with mungbean crop in the study areas were *Sudan grass* (Topas), *Rahynochosia malacophylla* (Teken), *Ipomoea spp*. (Dereya), *Indigofera spp*. (Demayto), *Corchorus trilocularis Auct* (Himeray) *Commelina foecunda* (Wuhankur) and *Xanthium abyssinicum* (Begdzemed). Among the two categories of weeds, broad leaved weeds showed more variation in species composition.

3.1 Number of Pods per Plant

The analysis of variance didn't reveal significant difference ($p>0.05$) on number of pods per plant among weeding period. However, the highest number of pods per plant (20.6) was recorded at keeping weed free up to 30 days after emergence, while the lowest (16.7) was recorded at weedy check (Table 2).

3.2 Number of Seeds per Pod

The analysis of variance revealed that there is significant difference ($p<0.05$) on number of seeds per pod among weeding periods compared to weed checks (Table 3). The highest number of seeds per pod (15.6) was recorded at completely weed free followed by weedy up to 20 DAS, 10 DAS, 30 DAS and weed free up to 40 DAS, while the lowest (10.1) was recorded at weedy check (Table 2). Poor number of seeds

per pod in weedy check could be due to severe competition for resource which resulted in poor over all plant performance and poor production and translocation of assimilates from source to sink. This is in line with Teame, et al. [11] who reported that water stressed plants of sesame poorly perform in overall plant performance.

3.3 Hundred Seed Weight (g)

The analysis of variance revealed highly significant difference ($p<0.01$) on hundred seed weight among weeding periods compared to weedy check except weed up to 30, 40, 50 and 60 DAS (Table 3). The remaining weeding periods were statically insignificant compared to completely weed free. The highest seed weight(3.8 g) was recorded at completely weed free and followed by weedy up to 10 days while the lowest (2.6 g) was recorded by weed check (Table 2). This lowest seed weight in weedy check could be due to sever weed competition for resource such as water, light and nutrients [8].

3.4 Seed Yield (kg/ha)

The combined analysis of variance revealed that there is highly significant difference ($p<0.01$) on yield among weeding periods (Table 3). The highest pooled yield in late competition (1607.0 kg/ha) was when mungbean was kept weed free up to 30 days though statically similar to weed free up to 40, 50 and 60 (Table 2). About 19% and 45% yield increment were obtained compared to farmers practice and weedy check. The current result also revealed a yield loss of 13.0% compared to completely weed free. This result is in line with Muhammad and Saeed (1999). These results are also in harmony with the results of Charles and Taylor [9] which indicated that removal of weeds in early stage gives good economical return in legume.

In early competition, the highest pooled yield 1638.0 kg/ha was obtained when mungbean kept weedy 20 days after sowing though statically insignificant with weedy up to 10 days after sowing. About 20% yield increment was obtained from weedy up to 20 DAS compared to farmers practice and 11% yield loss compared to completely weed free. Our results are in harmony with Dipali, et al. [12] who noted that keeping mungbean weed free up to 7-14 DAS boost yield. Similarly, Muhammad and Saeed (1999) reported weedy up to 10 days after sowing produced highest yield. Results of the current study in early competition treatment also revealed that mungbean seed yield increased when the duration of weed infestation period decreased.

The combined analysis of three winter seasons revealed that unrestricted weed growth significantly reduce yield of mungbean by 52% compared to completely weed free (Table 1). This result is in line with Shuaib [6], who reported mungbean yield could be lost from 65.4% to 79.0% due to weed competition.

Moreover, Fig. 2 displayed that the lowest yield loss was recorded at weedy up to 20 days and weedy up to 10 days after sowing in early competition, followed by weed free up to 30 days and 40 days in late competition. This result is nearly similar with Muhammad and Saeed (1999), who reported that critical weed period for mungbean is 20-30 days after sowing.

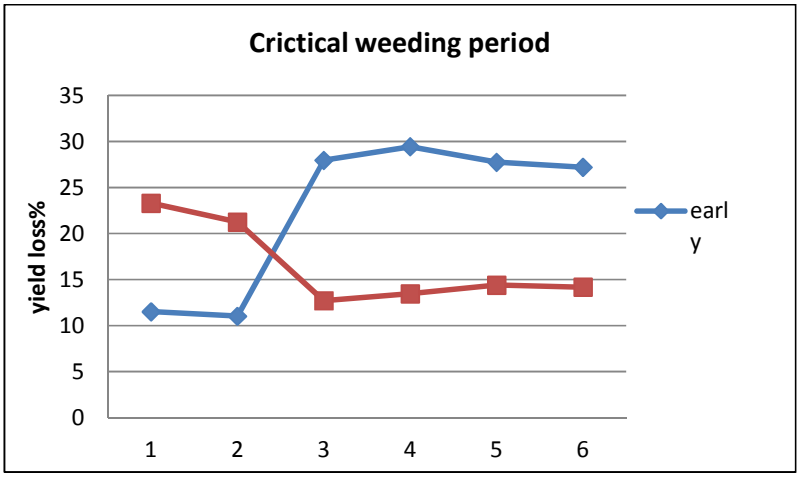

Fig. 2. Critical Weeding Period (CWP)

Table 2. Effect of weeding period on yield and yield components

Treatment	No. pods/plant	100 seed weight (g)	No. seed/pod	Seed yield (kg/ha)
Weedy up to 10 days	17.8	3.8	13.8	1629.0
Weedy up to 20 days	19.8	3.6	13.7	1638.0
Weedy up to 30 days	18.1	2.8	11.8	1326.0
Weedy up to 40 days	17.6	2.8	11.7	1299.0
Weedy up to 50 days	17.9	2.8	11.1	1330.0
Weedy up to 60 days	18.7	2.8	11.8	1215.0
Weed free up to 10 days	20.4	3.4	11.6	1412.0
Weed free up to 20 days	19.9	3.5	11.5	1450.0
Weed free up to 30 days	20.6	3.6	13.2	1607.0
Weed free up to 40 days	19.8	3.5	12.0	1593.0
Weed free up to 50 days	17.6	3.6	11.6	1576.0
Weed free up to 60 days	20.5	3.6	11.3	1573.0
Farmers practice	18.7	3.6	11.5	1300.0
Complete weed free	19.2	3.8	15.6	1841.0
Weedy check	16.7	2.6	10.1	889.0
CV(%)	15.0	9.6	9.4	23.0
LSD 0.05	NS	0.4	0.9	400.0

Table 3. ANOVA table for yield and yield component

Parameter		DF	S.S	M.S	Var	F pr.	level of significance
Pod number per plant	trt	14	405.6	28.9	1.53	0.104	NS
Hundred seed weight	trt	14	107.1	7.6	87.08	<.001	**
Number of seeds per pod	trt	14	1069.759	76.4	34.8	<0.968	**
Yield	trt	14	13766432	983317	876.56	<.001	**

4. CONCLUSION

The investigation indicates that the yield of mungbean is critically influenced by weeding period. Weedy up to 20 days, weedy up to 10 days, weed free up to 30 days and weed free up to 40 days had produced highest yield. So, mungbean should be kept weed free twice, namely 10-20 days after sowing and 30-40 days after sowing.

DATA AVAILABILITY

The data used to support this finding will be available up on request.

ACKNOWLEDGEMENT

The authors acknowledge Tigray Agricultural Research Institute, Humera Agricultural Research Center and pulse case team for providing the financial assistance and other facilities for the completion of this study. The authors also thank the colleagues who supported them during the study.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Rachie K, Roberts L. Grain legumes of the lowland tropics. Advances in Agronomy. 1974;1-132.
2. Lang T, Barling D, Caraher M. Food policy: integrating health, environment and society. OUP Oxford; 2009.
3. FAO.Production year book.Food and Agriculture Organization for the United Nations, Rome Italy; 2009. Bahabelom E; 2010.
4. Keatinge J, Easdown W, Yang R, Chadha M, Shanmugasundaram S. Overcoming chronic malnutrition in a future warming world: The key importance of mungbean and vegetable soybean. Euphytica. 2011; 180(1):129-141.
5. Tang D, Dong Y, Ren H, Li L, He C. A review of phytochemistry, metabolite changes, and medicinal uses of the

common food mungbean and its sprouts (*Vigna radiata*). Chemistry Central Journal. 2014;8(1):4.
6. Shuaib O. Critical period for weed competition in green gram. Univ. Aden. J. Nat. App. Sci. 2001;5:11-18.
7. Dungarwal H, Chaplot P, Nagda B. Chemical weed control in mungbean (Phaseolus radiatus L.). Indian Journal of Weed Science. 2003;35(3and4):283-284.
8. Arif M, Khan MA, Sajjad Akbar H, Ali S. Prospects of wheat as a dual purpose crop and its impact on weeds. Pakistan Journal of Weed Science Research. 2006;12(1-2): 13-17.
9. Charles G, Taylor I. Understanding the'critical period for weed control'concept. The Australian Cottongrower. 2007;28(4): 48.
10. Bahabelom E. The Status of Resettled Households on Food Security: The Case of Kafta Humera Woreda, Tigray, Ethiopia (Doctoral dissertation, Mekelle University; 2010.
11. Teame G, Tsegay A, Abrha B. Effect of organic mulching on soil moisture, yield, and yield contributing components of sesame (*Sesamum indicum* L.). International Journal of Agronomy. 2017;6.
12. Dipali M, Amaresh K, Subrata G, Pal D, Ghosh R. Determination of critical period of crop-weed competition in greengram (*Vigna radiata* L. Wilczek) in the Gangetic alluvial soil of India. Journal of Crop and Weed. 2006;2(1):13-14.

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle4.com/review-history/53387