Effect of Weeds in Yield Loss of Beans

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ABSTRACT

Weeds are unwanted plants growing in agricultural lands, gardens, road sides and mainly disturbed areas where they do not depend on human intervention for their reproduction and survival. Depending upon density, types, duration of competition, management practices and weather conditions, weeds may cause a reduction in crop yield. To determine the effect of weeds on the yield of beans, an experiment was carried out in University of Eldoret research farm in 2017 for two seasons. The area is located in Uasin Gishu county, Kenya and lies at an altitude of 2133 m above sea level. Geographically, the area is at 35^o 18' E longitude and 0^o 30'N latitude. The experiment was laid out as a factorial in Randomized Complete Block Design (RCBD) with three bean varieties and three treatments. The treatments were weed free plots, weedy plot and plots with single weeding. The data obtained were subjected to ANOVA using Genstat version 14 and means separated by Duncan's Multiple Range Test (DMRT). Results indicated that weeds significantly reduced the yield of all the three bean varieties from between 12-27%. From the results, it was deduced that all the bean varieties tested were susceptible to yield loss due to weeds. The study recommends for proper weed control in beans so as to realize good yields.

Keywords: weeds, competition, yield loss, varieties, management, duration.

INTRODUCTION

Weeds are one of the most serious problems in agricultural production. They are volunteer plants from the wild or semi culture crops that are found in food crops despite the will of the people and harm reducing yields. According to a FAO 2008 report, from the total losses worldwide caused by the crop pests, weeds account for 35% of losses in wheat, 28% in vegetables, 29% in fruits and 37% in tobacco (Slaveya et al., 2015). Since losses due to weeds are not as pronounced as those due to insect pests and diseases, the idea of weed control has been ignored for long. In spite of a multitude of control options, weeds still cause major losses in crop production. Documenting yield losses caused by weed infestation would supply a useful knowledge base which could be used to direct research goals in the area of weed management by identifying areas of greatest need (Oudhia, 2001). Weeds, through allelopathy have been found responsible for perturbation of emergence and stand establishment, growth, yield and physiology of crop plants.

Common beans (*Phaseolus vulgaris* L.) is the most widely grown legume in Kenya, with average per capita consumption of common bean in Africa estimated at 31.4kg/year (Schoonhoven and Voysest, 2011). Common Cultivars include; Rose coco , Canadian wonder, Kenya wonder, Zebra, *Mwitemania*, *Mwezi moja, mwezi mbili,* Red haricot, Nyayo, Wairimu Dwarf. Productivity of common beans is constrained by many factors among them weeds which compete for nutrients, space and sun light. In view of the losses caused by weeds, this paper therefore makes an attempt

to elucidate the effects of weeds to crop plants on areas of stand establishment, crop growth and yield parameters.

MATERIALS AND METHODS

Site description

The experiment was carried out in University of Eldoret farm, Uasin Gishu county which lies at an altitude of 2133 m above sea level. Temperatures range between 9.5^0 and $23.5\ ^0$C. Rainfall is bimodial and averages at 885 mm p.a. The soils are well drained, reddish brown ferrasols.

Test crop
The test crop was common bean of three varieties commonly grown: Rosecoco, Mwitemania and Mwezi mbili.

Treatments
In the present study, two weed control methods together with a control were studied. Three bean varieties were grown in two cropping seasons.

Experimental design and treatments
The experiment was a 3x3 factorial arranged in a Randomized Complete Block Design (RCBD) with three replicates. This gives a total of 27 plots.

The field arrangement is as shown below:

W1V1	W3V3	W2V2	W2V1	W1V2	W2V3	W3V1	W2V2	W3V3
W3V1	W1V2	W2V3	W1V3	W3V1	W2V2	W1V2	W3V2	W1V3
W3V2	W1V3	W2V1	W3V2	W3V3	W1V1	W2V1	W2V3	W1V1
Block 1			Block 2			Block 3		

Agronomic practices

All the required agronomic practices were applied as required.

Data collection

In order to meet the objectives of the experiment, data were collected on the following parameters:
Stand count at two weeks
The total number of bean plants in an experimental unit was counted and recorded two weeks after germination.

Stand count at harvesting
This is the total number of bean plants at the time of harvested. It was obtained by physically counting the stems per plot.
Number of seeds per pod
The number of seeds per pod was obtained after harvesting. Bean pods of selected plants were opened up and the number of seeds counted.
Number of pods per plant
This was obtained by physically counting the number of pods in randomly selected plants. An average was obtained per plot.

RESULTS
The table below shows the results of the experiment:

Table 1: Results of experiment

Parameter	Treatment	Season 1				Season 2			
		V1	V2	V3	Mean	V1	V2	V3	Mean
Stand count at 2 weeks	Weedy	45.67	44.00	44.33	44.67a	33.33	33.33	31.67	32.78a
	Weed free	45.33	45.67	45.33	45.44a	44.00	44.67	43.00	43.89c
	Single weeding	44.33	44.67	45.00	44.67a	39.67	39.00	40.00	39.56b
	DMRT 0.05				0.65				0.16
	Mean	45.11a	44.78a	44.89a		39.00a	39.00a	38.22a	
	DMRT 0.05	0.38				0.67			
	CV (%)	2.5				5.2			
Number pods per plant	Weedy	3.33	3.67	4.67	3.89a	1.67	2.33	2.00	2.00a
	Weed free	12.67	15.33	18.67	15.56c	14.67	17.00	17.67	16.44b
	Single weeding	8.00	14.33	11.67	11.33b	8.00	14.33	11.67	11.33c
	DMRT 0.05				1.08				0.97
	Mean	8.00a	11.11b	11.67b		8.11a	11.22b	10.44b	
	DMRT 0.05	0.62				0.56			
	CV (%)	18.2				16.9			
Number of seeds per pod	Weedy	1.33	2.00	1.67	1.67a	1.00	1.00	1.67	1.22a
	Weed free	6.33	7.33	10.67	8.11c	7.00	7.33	10.00	8.11c
	Single weeding	4.33	5.33	6.33	5.33b	5.67	5.67	5.67	5.67b
	DMRT 0.05				0.48				0.43
	Mean	4.00a	4.89b	6.22c		4.56a	4.67a	5.78b	
	DMRT 0.05	0.27				0.25			
	CV (%)	16.3				14.7			
Stand count at harvesting	Weedy	12.33	16.33	22.00	16.89a	10.33	13.33	15.67	13.11a
	Weed free	44.00	43.67	45.00	44.22c	44.00	43.67	45.00	44.22b
	Single weeding	36.00	39.33	40.00	38.44b	36.00	39.33	40.00	38.44c
	DMRT 0.05	1.61				1.70			
	Mean	30.78a	33.11ab	35.67b		30.11a	32.11ab	33.56b	

	DMRT 0.05	0.93	0.98
	CV (%)	8.4	9.2

DISCUSSION

Effect of treatment on stand count at two weeks and at harvesting

From the analyzed results, treatment and variety of the beans did not significantly influence the stand count of beans at two weeks in season 1. In season 2, weedy plots had significantly lower stand counts at two weeks. The results can be attributed to the effect of the weeds affecting germination of crops through allelopathy. According to Kholi *et al*., 2004, allelochemicals produced by plants act through interference with physiological functions of receiver plants such as seed germination, root growth, shoot growth and stem growth. In addition to allelopathy, stand count at harvesting was affected by competition thereby weak bean plants were outcompeted in weedy plots.

Effect of treatment and variety on bean yield parameters (number of pods per plant and number of seeds per pod)

The results shown above demonstrate that the variety usedhad significant effects on the number of pods per plant and the number of seeds per pod, which are important determinants of yield.Variety 2 (Mwitemania) and Variety 3 (Mwezi mbili) have a natural ability to grow tendrils. This is an advantage to them in weedy environments where the tendrils twine on strong weeds and are able to access the sun for photosynthesis. Due to this, the varieties performed better at a mean of 11 and 12 pods per plant and 5 and 6 seeds per pod respectively.

On treatment, there were significant differences in all the treatments applied on the parameters in question. This can be attributed to competition and allelopathy. In weedy plots, competition for nutrients, space, light and pollinators was high and the plants set aside much of their resources in countering the impact of competition rather than to production. Allelopathic effects of weeds were also noted whereby there was plant death around some specific weeds.

The impact of allelochemicals on plant photosynthesis mainly involve inhibition of or damage to the synthesis machinery and acceleration of the decomposition of photosynthetic pigments (Rao *et al.,* 2007). Consequently, photosynthetic pigment contents are decreased, which blocks energy and electron transfer, reduces ATP synthesis enzyme activity, inhibits ATP synthesis and affects stomatal conductance and transpiration, which inhibit photosynthesis (Wu *et al*., 2004). All these lead to decreased crop yields.

CONCLUSION AND RECOMMENDATIONS

This study concluded that crop yield can be reduced due to weed interference. Emphasis is placed on the importance of weed management in bean production and the need for continued weed

science research to develop long-term, sustainable, integrated weed-management systems that are tailored to the various crop-producing regions.

There is need for continous up-to-date research on weed control in beans that can ensure higher yields for the farmers and hence food security.

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