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Studies on effect of integrated weed management on seed growth parameters in cucumber (*Cucumis sativus* L.)

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Abstract
The present investigation was carried out to study the effect of integrated weed management on the seed growth parameters of cucumber. The study was conducted at the Department of Vegetable Science, Horticultural College and Research Institute, Coimbatore during 2019-2020. The experiment was laid out in Randomized Block Design. Different combinations of pre and post emergence herbicides were used to control the weed population. A total of eleven treatments were used and were replicated three times. Observations on seed growth parameters *viz.*, germination percentage, speed of germination, seed vigour index I and seed vigour index II were recorded. Among the different treatments, Post emergence application of Quizalofop @ 40g/ha @25DAS with one hand weeding 45 DAS showed better seed growth parameters. The results showed that the treatment T_4 (Post emergence application of Quizalofop @ 40g/ha @25DAS) recorded the highest germination percentage (87), speed of germination (11.1), seed vigour index I (2294.5) and seed vigour index II (1.31).The lowest seed growth parameters were recorded in T_{11} (weedy check). Hence, it can be concluded that post emergence application of Quizalofop @ 40g/ha @25DAS can be beneficial in controlling the weed population in cucumber.

Keywords: Cucumber – integrated weed management – seed growth parameters

Introduction
Cucumber (*Cucumis sativus* L.) is one of the important vegetable crops grown throughout India and belongs to the family cucurbitaceae. It is considered as the fourth most important vegetable crop next to tomato, cabbage and onion in Asia. (Tatlioglu, 1993) [12]. Though it is cultivated all over India there are several impediments in cultivating cucumber of which the most important one is the problem posed by the weeds which compete for the space, light, nutrients and water (Abbasi *et al*., 2013) [1]. The yield loss due to weed population depends on the type of weed, weed population, weed intensity and the agro climatic conditions. Though manual weeding is commonly practiced, it is cumbersome and costlier (Warade *et al*., 2007) [13] Integrated weed management (IWM) is an important tool to control weed population (Shweta and Singh, 2005). Lamichhane *et al*. (2017) [9, 5] found that integrated weed management was more effective than any single method in alleviating the buildup of weeds in crops. Pooniya *et al*., 2017 [7] observed that the weed population can be maintained below the economic threshold level by an integrated approach.
Although cucurbits are less vulnerable to weed competition, after the vines establish completely, the crop is exposed to weed menace until the crop covers completely. Weeds that emerge during this time promote fungal diseases and thereby cause yield reduction. Winter squash and pumpkin usually form heavier, more weed-suppressive foliage than cucumber. Gaps in the crop stand, or late season defoliation by pests, diseases, or plant senescence can result in more weed growth and affects the seed quality.

Materials and Methods
The research was conducted at the Department of Vegetable Science, Horticultural College and Research Institute, Coimbatore during 2019-2020. The experiment was laid out in a Randomised Block Design with three replications. The following were the treatments imposed to have a check over the weed population.

Treatments
T_1: Pre emergence application of Pendimethalin @0.75ai/ha

T$_2$:   Pre emergence application of Pendimethalin @0.75ai/ha + one hand weeding 45 DAS

T$_3$:   Post emergence application of Quizalofop @ 40g/ha @25 DAS

T$_4$:   Post emergence application of Quizalofop @ 40g/ha @25DAS+ one hand weeding 45 DAS

T$_5$:   Pre emergence application of Pendimethalin @0.75ai/ha + Post emergence application of Quizalofop @ 40g/ha @25DAS

T$_6$:   Pre emergence application of Pendimethalin @0.75ai/ha + Post emergence application of Quizalofop @ 40g/ha @25DAS+ one hand weeding 45 DAS

T$_7$:   Mulching with black polyethylene

T$_8$:   Organic mulch

T$_9$:   Hand weeding 25 and 45 DAS

T$_{10}$:   Weed free check

T$_{11}$:   Weedy check

After harvest, observations were recorded on seed growth parameters *viz.*, germination percentage, speed of germination, seed vigour index I and seed vigour index II.

Germination percentage
Germination percentage is an estimate of the viability of a population of seeds. The germination rate provides a measure of the time course of seed germination. The equation to calculate germination percentage is:

Germination percentage = seeds germinated / total seeds x 100

Speed of germination
Seeds were observed daily for seed germination (radicle emergence). Speed of germination was calculated by the following formula

Speed of germination = n1/d1 + n2/d2 + n3/d3 + ----------
Where, n = number of germinated seeds, d= number of days.

Seedling length (cm)
The seedling length was measured from the collar region to the tip of the primary leaf. The mean seedling length was expressed in centimeters.

Seedling dry weight (mg)
The selected seedlings were kept in butter paper and dried in hot air oven at 80 ± 1^0C temperature for 24 hours. Then seedlings were removed from oven and allowed to cool before weighing on an electronic balance. The average weight of dried seedlings from each replication was calculated and expressed as dry weight of seedling in milligrams.

Seedling Vigour Indices
Seedling vigour indices were calculated by using the below formula as suggested by Abdul-Baki *et al.*, 1973 [2] and expressed in whole number.
Vigour Index I = Germination (%) x Seedling length (cm)
Vigour Index II = Germination (%) x seedling dry weight (mg)

Statistical analysis
The mean value of observations recorded on different seed parameters was subjected to statistical analysis. The analysis of variance for seed parameters were done by the method suggested by Panse and Sukhatme, 1967 [6].

Results and Discussion
Observations on seed growth parameters *viz.*, germination percentage, speed of germination, seed vigour index I and seed vigour index II were recorded after harvesting the crop has been given in Table.1

Table 1: Effect if IWM on seed growth parameters in cucumber

Treatments	Germination percentage	Speed of germination	Vigour index I	Vigour index II
T$_1$ (Pre emergence application of Pendimethalin @0.75ai/ha)	55.0	7.0	1226.1	0.84
T$_2$ (Pre emergence application of Pendimethalin @0.75ai/ha + one hand weeding 45 DAS)	58.0	7.0	1299.8	0.74
T$_3$ (Post emergence application of Quizalofop @ 40g/ha @25DAS)	59.6	6.8	1386.8	0.89
T$_4$ (Post emergence application of Quizalofop @ 40g/ha @25DAS+ one hand weeding 45 DAS)	87.0	11.1	2294.5	1.31
T$_5$ (Pre emergence application of Pendimethalin @0.75ai/ha + Post emergence application of Quizalofop @ 40g/ha @25DAS)	79.6	8.9	1353.1	1.08
T$_6$ (Pre emergence application of Pendimethalin @0.75ai/ha + Post emergence application of Quizalofop @ 40g/ha @25DAS+ one hand weeding 45 DAS)	81.0	10.0	2040.9	1.23
T$_7$ (Mulching with black polyethylene)	79.0	9.0	2072.7	1.07
T$_8$(Organic mulch)	83.6	10.5	2038.5	1.19
T$_9$ (Hand weeding 25 and 45 DAS)	81.0	9.6	1885.8	1.00
T$_{10}$ (Weed free check)	76.0	8.1	1778.5	0.89
T$_{11}$ (Weedy check)	54.0	6.8	1159.4	0.70
CD (0.05)	1.6	6.4	62.1	0.07
CV%	17.4	59.8	29.4	20.2

Germination percentage
The treatment combinations expressed significant differences on the seed growth parameters. Among the different treatment combinations, the Germination percentage was the highest (87.0) in T$_4$ (Post emergence application of Quizalofop @ 40g/ha @25DAS+ one hand weeding 45 DAS) while it was the lowest (54.0) in T$_{11}$ (Weedy check). The combination of pre and post emergence herbicides and hand weeding helps in keeping the field weed-free during the initial stages of crop establishment. The cost involved in weeding is reduced considerably due to hand weeding during later stages of crop growth and also helps in maintaining the weed population. (Shivalingappa *et al.*, 2014) [10]. In a study conducted by Prabhu *et al*., 2006 [8], application of 50 per cent recommended dose of fertilizers + vermicompost @ 2 t/ha + biofertilizers (2 kg in each of *Azospirillum* and Phosphobacteria @ 2 kg ha^{-1}) increased the vine length, earliness in flowering, yield and yield components.

Speed of germination

The highest Speed of germination (11.1) was recorded in T_4 (Post emergence application of Quizalofop @ 40g/ha @25DAS+ one hand weeding 45 DAS) whereas the lowest (6.8) was registered in T_3 (Post emergence application of Quizalofop @ 40g/ha @25DAS) and T_{11} (Weedy check). This may be attributed to the fact that weed free plot would have contributed to better growth of cucumber fruits which in turn resulted in better seed growth. Friesen, 1978 conducted a study in cucumber and reported that the critical period of weed interference was between 12 and 36 days after crop emergence. Similarly, Weaver, 1984 [14] concluded that cucumber yield was reduced when the field was not maintained weed-free.

Vigour indices

Among the different treatments, the Vigour index I and the Vigour index II were the highest (2294.5 and 1.31) in T_4 (Post emergence application of Quizalofop @ 40g/ha @25DAS+ one hand weeding 45 DAS) while the lowest values (1159.4 and 0.70) were observed in T_{11} (Weedy check). The results show that weed-free plot contributes to better absorption of nutrients by the plants and therefore results in better fruit and seed growth. Similar results were obtained in cauliflower by Quasem, 2007 and in okra by Kolse *et al.*, 2010 [11, 4].

Conclusion

From the experiment it can be concluded that Post emergence application of Quizalofop @ 40g/ha @25DAS along with one hand weeding 45 DAS has been beneficial in improving the seed growth parameters such as germination percentage, speed of germination, vigour index I and vigour index II than the other treatments experimented in the study. Hence it can be suggested that Post emergence application of Quizalofop @ 40g/ha @25DAS along with one hand weeding 45 DAS is effective in controlling the weed population in cucumber.

Acknowledgement

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