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INTEGRATED WEED MANAGEMENT IN BITTER GOURD IN THE AGRO-ECOLOGICAL CONDITIONS OF PESHAWAR

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ABSTRACT

In order to study the effect of different weed control methods, an experiment was conducted in summer 2012 at the New Developmental Farm, the University of Agriculture Peshawar. The treatments comprised of four mulches (Rumex crispus, Silybum marianum, news papers, and saw-dust), a herbicide i.e. Stomp 330 EC (pendimethalin) as pre-emergence, a hand weeding and a control treatment (weedy check). Data were collected on weed density, number of plants ha^{-1} and total fruit yield. Weed density was the highest (540 weeds m^{-2}) in the weedy check treatment and the lowest in the hand weeded plots (80 m^{-2}). The reduction in weed population was 97% in the hand weeded treatments as compared to the control treatments. The weed parameters were statistically at par in the rest of the treatments. However, the reduction in weed population was more than 42% in the rest of the treatments. The highest number of fruits plant^{-1} (4.20) and total fruit yield (4050 kg ha^{-1}) were recorded in the hand weeded treatments followed by the treatment of Stomp 330 EC. Moreover, the performance of the mulching treatments was also significantly more effective than the weedy check plots. Keeping in view the cost of production and the environmental safety, the hand weeding and herbicide use cannot be preferred for use as weed management tools. Therefore, mulching treatments should be given place for weed management purpose as it is cost effective, more environment friendly and long lasting.

Key words: Bitter gourd, integrated weed management, Peshawar,

INTRODUCTION

Bitter gourd (*Momordica charantia* L.) is a widely grown crop throughout the world, especially in the tropical areas for its edible fruit (El-Batran *et al*., 2006) and belongs to the family cucurbitaceae. Its centre of origin is believed to be in Eastern India and Southern China but high species diversity occurs in Africa (Joseph, 2005). Momordica actually means 'to bite' referring to the jagged edges of the leaf, which appear as if bitten. The fruit is oblong and resembles a small cucumber, young fruit is emerald green that turns to orange-yellow when ripened

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(Saeed *et al*., 2010). Bitter gourd is cultivated as an important vegetable crop in many areas of Pakistan (Tahir and Haider, 2005). Total Area under bitter gourd in Pakistan was 6080 ha and the total production was 56239 t while at the provincial level of Khyber Pakhtunkhwa the total area was 894 ha and the production was 6483 t. (Government of Pakistan, 2010).

In spite of being medicinally so important and potentially so economic crop, the yields have always been very low. There would be a lot of factors responsible for the lower yields, like reduced acreage under production without even considering insufficient pollination. However, the obscure impact of weed competition cannot be ignored, as vegetables are always quite vulnerable to weed interference. Some of the most troublesome weeds of cucurbit crops include nut sedges, bermudagrass, morning glories, pigweeds, common cocklebur, rag weeds, and horse nettle (Webster, 2006). The minimum weed-free period in cucurbit crops has been estimated as the first 4 to 6 weeks after planting (Noble, 2009;). Weeds that emerge after bitter gourd vines begin to spread have little direct effect on crop yield, but can interfere with harvest, promote disease, or propagate themselves. Organic weed management is especially challenging at this time, because mechanical cultivation can damage crop vines and shallow feeder roots, and manual removal is labor intensive. Late-emerging weeds can set many seeds, especially during the long maturation periods of the cucurbits (Stall, 2009). The crop is most vulnerable to weed competition during the emergence and establishment phase, and is also easiest to keep clean through cultivation during this time. When the crop plants are established, but vines have not yet begun to run out, bitter gourd crop can tolerate a moderate amount of hilling-up (soil moved into the row), a practice that buries and kills within-row weed seedlings (Schonbeck, 2011). However, there are no satisfactory studies found having earlier been conducted on the interaction of the cucurbit crop with weeds. Therefore, the experiment was conducted with the objectives to find out the impact of some cultural weed control techniques on weeds growth and population, to assess the effects of different mulches on crop yield, to compare the efficacy of mulching treatments with hand weeding, a herbicide and weedy check, and to develop an eco-friendly weed management package to boost the crop growth in the long run.

MATERIALS AND METHODS

The research study entitled "Integrated weed management in bitter gourd in the agro-ecological conditions of Peshawar" was conducted at the Research Farm of the University of Agriculture, Peshawar, during summer 2012. The experiment was laid out in a

randomized complete block design (RCBD), replicated 4 times. A total of seven treatments were used in the experiment including four mulching treatments i.e. *Rumex crispus* as mulch, *Silybum marianum* as mulch, news papers as mulch and saw dust as mulch, along with the treatments of stomp 330 EC applied at the rate of 1.2 L ha^{-1}, a hand weeding and a weedy check (control). All the cultural practices were carried out according to the crop requirements. The land was prepared for sowing on 16 March and bitter gourd was sown at 17th March 2012.

The seed of local recommended variety "Indian karela" was sown. The plot size was kept 3m × 3m. Seeds were sown on one side of the ridges with a depth of 2 - 2.5 cm and keeping the plant to plant distance of 30 cm. The ridges were made in the direction of east to west. The recommended dose of nitrogen was applied at the rate of 60 kg ha^{-1} to the bitter gourd crop. DAP fertilizer was applied before sowing crop and Nitrogen was applied after sowing as per standard requirements. The crop was irrigated according to its requirements. The data were recorded from different treatments on the following parameters i.e. weed density m^{-2}, number of plants ha^{-1} and total fruit yield.

All data collected were subjected to analysis of variance (ANOVA) using computer software MSTATC and then Fisher's least significant difference (FLSD) at 5% level of probability was used to separate the treatment means (Akindele, 1996).

RESULTS AND DISCUSSION

Weed density m^{-2}

Statistical analysis of the data (Table-1) revealed that different treatments showed significant effects ($P<0.05$) on weed density m^{-2}. The maximum weed density (540 m^{-2}) was recorded in weedy check plots whereas minimum weed density of 12 m^{-2} was observed in the hand weeded treatments, followed by the herbicide treatment (90 m^{-2}). The rest of the cultural practices for management were statistically at par. It is obvious from the results that hand weeded treatments performed the best; however, there are certain constraints due to which this treatment can't be utilized everywhere. The first hurdle is that hand weeding is very costly if manpower is not available at home. Secondly it is time consuming which again requires specified personnel to carry out the practice. Therefore, hand weeding is only practicable if sufficient and free labour is locally available, otherwise in this era of inflation it becomes quite unacceptable to invest in such weed management tools.

There were twelve different weeds found in the experiment field. These weeds included *Anagallis arvensis, Ammi visnaga, Cyperus*

rotundus, Sorghum halepense, Euphorbia helioscopia, Rumex crispus, Ranunculus muricatus, Convolvulus arvensis, Digitaria sanguinalis, Coronopus didymus, Chenopodium album and *Plantago lenceolata.* The weeds were though overall more in number however their sizes were quite small at the time of data collection. The percent reduction in weed biomass as a result of the applied treatments was also computed for each treatment. After hand weeding treatment the highest reduction of 55% in weed population was found in Stomp 330EC plots followed by the treatment of saw dust as mulch (72%). According to Rao (2000), a reduction of one kg biomass of weeds will correspond to an increase in one kg of the crop associated. The similar result was also reported by Shiyam *et al*. (2011) who reported that weed infestation was more serious in bare plots than in plots that were covered with sawdust mulch and effectively control weed density. High smothering effect of dry mulches on weed growth also reported by Okhira *et al.* (1993). Usman *et al*. (2005) also reported that straw mulch and Stomp 330 EC + hand weeded once, have the greatest weed control.

Number of fruits plant^{-1}

The analysis of variance of the data (Table 2) revealed that the different treatments had a significant effect on the number of fruits per plant. A larger number of fruits (4.20) plant^{-1} was observed in hand weeding treatments followed by Stomp 330 EC (2.37 plant^{-1}). Less number of plants (1.00) was investigated in weedy check plots, which was though statistically at par with the rest of the treatments. The effects of the *Rumex crispus* as mulch, *Silybum marianum* as mulch and news paper as mulch were almost identical. The number of fruits plant^{-1} is a good indicator of the final yield. Ibeawuchi *et al*. (2008) reported that mulching significantly affected the total yield, number of fruits per plant.

Total yield (kg ha^{-1})

The analysis of the data illustrated that like all other studied components total fruit yield (kg ha^{-1}) was also significantly affected by the different treatments applied (Table-1). The data explored that highest total fruit yield (4050 kg ha^{-1}) was obtained in hand weeding plots which were statistically at par with stomp 330 EC (3555 kg ha^{1}) while lowest total fruit yield (1432 kg ha^{-1}) was found in weedy check. Greater weeds infestation in weedy check treatments severely reduced the total fruit yield (4050 kg ha^{-1}) of the bitter gourd crop. Best yield recorded in different control treatment resulted from effective weed control causing maximum nutrient utilization by the crop plants and low intraspecific competition. Similar conclusions have also been drawn by Bostrom and Fogelfors (2002) that proper weed management gave higher yields of crops. The result on yield also

agreed with Tran (1993) that mulching affect the total yield of cucumber.

Table-1. Weed density m^{-2}, number of fruits $plant^{-1}$ and total yield (kg ha^{-1}) as affected by the different treatments in bitter gourd.

Treatments	Weed density m^{-2} (% mortality)	No. of fruits $plant^{-1}$	Total fruit yield (kg ha^{-1})
Hand weeding	12 d (97%)	4.20 a	4050 a
Weedy check	540 a (--)	1.00 b	1432 e
Rumex crispus as mulch	311 b (42%)	1.20 b	2352 d
Silybum marianum as mulch	293 bc (45%)	1.30 b	2229 d
News paper as mulch	220 bcd (59%)	1.60 b	2781 c
Saw dust as mulch	148 bcd (72%)	1.20 b	3242 b
Stomp 330 EC (PRE)	90 cd (83%)	2.37 b	3555 b
$LSD_{0.05}$	215	1.74	350.0

Means with different letters are significant at 5% probability level

CONCLUSIONS

Weed competition does have an impact on the performance of the bitter gourd crop. Overall, the hand weeded treatments gave the best results in terms of weed reduction and yield improvement. The mulching treatments on the other hand closely followed the hand weeding and the herbicide used, which is a very good indicator for decreasing the reliance on chemical weed control and for saving money and labour. Therefore, mulches should be included in the weed management strategies in future. Crop yield definitely was enhanced by the mulching treatments as compared to the weedy check. In the end, it can be declared that mulching can result in a strong eco-friendly weed management tool to boost the crop growth and maintain the environmental safety in the long run. As the mulching treatments exhibited results at par with the herbicide, the general farmers must be informed of the effectiveness of the cultural treatments and also to switch over to the eco-friendly weed management tools rather than to hang on to the synthetic chemicals and hand weeding. This will encourage the farmers to reduce the reliability on chemical weed control.

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