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Influence of different weed control methods on weeds and yield of tomato *(Solanum lycopersicon* L.)

Salma Niaz[1], SohailIrshad[*2], Madeeha Imdad[3], Mubashra Yasin[1], Muhammad Zahid Mukhtar Bhatti[4], Muhammad Atif Ghafoor[5]

[1]*Sugarcane Research Institute, AARI, Faisalabad, Pakistan*

[2]*In-Service Agricultural Training Institute, Rahim Yar Khan, Pakistan*

[3]*Extension and Adaptive Research, Punjab Agriculture Department, Pakistan*

[4]*In-Service Agricultural Training Institute, Sargodha, Pakistan*

[5]*Soil and Water Testing Laboratory, Rahim Yar Khan, Pakistan*

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Abstract

Weeds are major problem in crop production and reduce the yield of crops by competing nutrients, light, space and water therefore, this problem needs more attention. To address the problem of weeds an experiment was conducted at kitchen gardening training center for women 62JB Chananky, Faisalabad, Pakistan during 2016 to evaluate the effect of different weed control methods on weeds and yield of tomato. The experiment was laid out in randomized complete block design (RCBD) with three replications and four treatments i.e. black plastic mulch, herbicide application (*fenoxaprop-p-ethyl)*, hand weeding and weedy check (Control). Two varieties of tomato (Naqeeb and Riogrande) were selected for the experiment and sown in a plot size of 2.4 m x 3 m for each variety. Highest weed density of 3.80 weeds m^{-2} for Naqeeb and 4.77 weeds m^{-2} in case of Riogrande, fresh weed biomass of 49.50 t ha^{-1} for Naqeeb and 49.68 t ha^{-1} in case of Riogrande and dry weed biomass 25.95 t ha^{-1} for Naqeeb and 26.03 t ha^{-1} in case of Riogrande were recorded in the weedy check plots. Hand weeding resulted in the highest number of fruits $plant^{-1}$ (35.5 for Naqeeb and 32.1 in case of Riogrande), plant height (59.33 cm for Naqeeb and 60.67 cm in case of Riogrande) and yield of tomato (4.6 t ha^{-1} for Naqeeb and 4.3 t ha^{-1} in case of Riogrande). Therefore, hand weeding resulted as the most effective treatment in terms of weeds suppression and yield enhancement of tomato crop.

* **Corresponding Author:** Sohail Irshad ✉ sohail_99uaf@yahoo.com

Introduction

Tomato (*Solanum lycopersicon* L.) belongs to the family solanaceae, and is cultivated all over the world as an annual crop. Tomato is a popular and nutritive vegetable crop ranking next to potato in world's vegetable production. Tomato is an important source of minerals and antioxidants such as carotenoids, lycopene, vitamins C, E and phenolic compounds, which have a key role in human nutrition to prevent certain cancer and cardiovascular diseases (Adalid *et al.*, 2004). Tomatoes are consumed in a number of ways including sun-dried tomatoes, tomato sauce, tomato juice, tomato soup, tomato ketchup and fresh as salad (Frusciante *et al.*, 2007).

Several factors contribute for the low yield of tomato of which weeds not only reduce yield, quality and value of the crops but also increase production and harvesting cost. Low yield of tomato crop is pertinent to weeds because of various factors such as competition for light, space and nutrients. Weeds also reduce the harvest index and biological yield of tomato (Abbasi *et al.*, 2013). Some weeds act as an alternate host for insect pests and diseases and enhance the chances of pests attack. In tomato production, weed control has always been a vital constituent, better weed management strategies in tomato results in higher production and also cope with the viral disorders of the crop. Marana *et al.* (1986) reported that critical period of weed competition is 30-40 days after sowing of the tomato, they further reported reduced tomato fruit yield up to 70% depending on stage and duration of weed competition. Shadbolt and Holm (1956) revealed from their study that the first four weeks were critical for weed control in many vegetable crops. Tomato yield reduction up to 57% was observed due to weeds infestation as compared to weedy check (Govindra *et al.*, 1986). Adigun (2000) recorded up to 95% reduction in tomato yield due to the uncontrolled weed growth all through the life cycle of tomato crop.

Herbicides are effective way in controlling weeds, but at the same time these are expensive and often beyond the budget of farmers. Herbicide use requires particular equipment and expertise with recommended rates and optimum time furthermore; there are many human health and environmental issues regarding the use of herbicides (George *et al.,* 2013; Shamim *et al.,* 2013). Mulching is a topical and imperative non-chemical weed control method. In mulching soil surface is covered with different materials such as plastic sheets or paper etc. This practice is important to conserve soil moisture and is a better weed management strategy in many crops and vegetables.

Keeping in view the losses in yield due to weeds in tomatoes, this study was conducted for the development of an integrated weed management strategy in tomatoes to sustain the yield and minimize the losses due to weeds.

Materials and methods

Experimental site

An experiment was conducted to evaluate the effect of different weed control methods on weeds and yield of tomato at kitchen gardening training center for women 62JB Chananky Faisalabad, Pakistan, during the year 2016.

Experimental design and treatments

The experiment was comprised of four treatments i.e. black plastic mulch, herbicide application (fenoxaprop-p-ethyl), hand weeding and weedy check (control). The experiment was laid out in a randomized complete block design having three replications.

Crop husbandry

Tomatoes varieties (Naqeeb and Riogrande) were transplanted after 30 days with row to row and plant to plant distances of 60 and 30 cm, respectively. Urea and DAP were used as a source of nitrogen and phosphorus. Nitrogen was applied in two splits (half at transplanting time and half after 30 days of transplanting) at the rate of 120 kg ha^{-1}. Herbicide, fenoxaprop-p-ethyl @ 2.0 $kgha^{-1}$ was applied. Black plastic sheet as mulch material was kept between tomato rows soon after transplanting of tomato nursery.

Data collection

Data was recorded on weeds density m^{-2}, fresh and dry weeds biomass (kg ha^{-1}), fruit length (cm), fruits $plant^{-1}$ and yield (kg ha^{-1}). Weed density was recorded at 20 days after transplantation (DAT) from randomly selected three central rows from each experimental unit and was averaged to get weeds density m^{-2}. Fresh and oven dry weeds biomass of the samples were also recorded. Average fruit length was taken by measuring the fruit picked from five randomly selected plants and their average was calculated. Five plants were selected at random in each plot and tagged. The total numbers of fruits obtained from the selected plants were divided by 5 to get the average number of fruit $plant^{-1}$. Yield ha^{-1} was calculated by the following formula;

$$Yield\ t/ha = \frac{Yield\ of\ plot\ (t)}{Area\ of\ plot\ (m)} X10000(m)$$

Statistical analysis

The data collected was analyzed by using standard procedure of Fisher's analysis of variance technique by using Statistix 8.1 version, a computer package for statistical analysis. Individual comparison of treatment means were made by using least significant difference test (LSD) at 5% probability level (Steel *et al.*, 1997).

Results and discussion

Weed density (m^{-2})

All treatments showed significant result on weed density m^{-2} (Table 1).

Table 1. Influence of different weed control methods on weed density and fresh and dry weed biomass.

Treatments	Weeds density m^{-2}		Fresh weeds biomass (t ha^{-1})		Dry weeds biomass (t ha^{-1})	
	Riogrande	Naqeeb	Riogrande	Naqeeb	Riogrande	Naqeeb
Weedy Check	4.77 a	3.80 a	49.68 a	49.5 a	26.03 a	25.95 a
Hand Weeding	1.77 b	1.50 b	19.03 c	18.93 c	14.50 c	14.40 c
Herbicide	3.90 b	2.93 b	23.06 c	22.95 c	14.88 c	14.75 c
Black Plastic	2.77 b	2.55 b	29.70 b	29.48 b	17.25 b	17.23 b
LSD 5%	1.12	1.12	2.20	2.02	1.95	1.90

Means followed by different letters are different statistically at 5% level of probability.

Higher weed density was in weedy check plots it may be due to the open soil surface and niches available to weeds for free and aggressive growth. In case of hand weeding less weed density might be due to appropriate weeding at right time. These results are in line with those of Hassan *et al.* (1995), Fathi *et al.* (2003), and Hassan and Ahmad (2005) they reported more weed population in weedy check plots and less weed density m^{-2} in case of hand weeding.

Fresh and dry weed biomass (t ha^{-1})

Significant reduction in fresh and dry biomass of weeds was observed in hand weeding and herbicide applied treatments (Table 1). Timely eradication of weeds in hand weeding plots could be the possible reason for lower weeds fresh biomass in theses plots. Syawal (1998) and Khan *et al.* (1998) also reported that hand weeding is the most effective weed control method in many vegetables. Unger and Ackermann (1992) reported that mulches reduced weed biomass from 41 to 94%. Moreover, Gul *et al.* (2011) reported that weed fresh biomass was significantly lower in hand weeding plots due to the removal of weeds at early stage of the crop.

Number of fruits per plant

Number of fruits per plant was significantly affected by different weed control methods (Table 2). In weedy check plots less number of fruits per plant might be due to the increased competition for moisture, light and nutrients. In addition, the decrease in fruits per plant was proportional to duration of weeds competition. Higher fruits per plant in weed control plots than weedy check might be due to better growth and development of tomato

plants and availability of more resources which resulted in more fruit production. The results are in accordance with those of Dennis *et al.* (1989) who found increase in the number of fruit per plant in case of mulching.

Plant height (cm)

Data pertaining plant height (cm) is presented in (Table 2).

Negotiations of the data for plant height specify that different weeds control practices caused significant variation in height of tomato plants. Less competition for available resources like nutrients, light and space might be possible reason for increasing plant height in the respective plots. Same results were obtained by Hassan *et al.* (1995) who reported increase in plant height of tomatoes due to weed control measures.

Table 2. Influence of different weed control methods on fruits per plant, plant height and yield of tomato.

Treatments	Fruits per plant		Plant height (cm)		Yield (t ha^{-1})	
	Riogrande	Naqeeb	Riogrande	Naqeeb	Riogrande	Naqeeb
Weed Check	12.2 d	15.3 d	50.62 d	49.68 d	2.9 d	3.0 d
Hand Weeding	32.1 a	35.5 a	60.67 a	59.33 a	4.3 a	4.6 a
Herbicide	24.4 b	26.6 b	56.93 b	54.22 b	3.5 b	3.8 b
Black Plastic	18.5 c	20.1 c	52.33 c	51.67 c	3.1 c	3.3 c
LSD 5%	1.30	1.31	3.03	2.96	1.12	1.20

Yield (kg ha^{-1})

Yield is the outcome of various yield components that were significantly ($P < 0.05$) affected by different weeds control methods (Table 2). Less competition for nutrients and other available resources in hand weeding plots resulted in higher yield of tomato. Our results are confirmed by the findings of Chalfant *et al.* (1977) who found increase in yield of tomato due to proper weed management attributed to more favorable soil moisture and nutrient utilization by plants. Siborlabane (2000) also revealed that the yield and quality of tomato varies according to the type of mulch and weed control method.

Conclusion

It is concluded from the above study that hand weeding is the most effective weed control method which ultimately enhances growth and yield attributes of tomato. Therefore, it is recommended that hand weeding should be done in vegetable crops like a tomato at least twice in the full growing season, and also it should be a part of the integrated weed management program along with the mulching treatments, that were statistically at par with the hand weeding in the experiment. Looking at the cost of crop production mulching as well should be encouraged.

References

Abbasi **NA, Zafar L, Khan HA, Qureshi AA.** 2013. Effects of naphthalene acetic acid and calcium chloride application on nutrient uptake, growth, yield and post-harvest performance of tomato fruit. Pakistan Journal of Botany **45,** 1581-1587.

Adalid AM, Rosello S, Nuez F. 2004. Breeding tomatoes for their high nutritional value. Recent Research and Development in plant Science **2,** 33-52.

Adigun JA. 2002. Chemical weed control in transplanted rainfed tomato (*Lycopersicon esculentum* Mill) in the forest-savanna. Transition zone of south western Nigeria. Agriculture and Environment **2**, 141-150.

Alabi DA. 2006. Effects of fertilizer phosphorus and poultry droppings treatments on growth and nutrient components of pepper *(Capsicum annuum* L). African Journal of Biotechnology **5,** 671-677.

Amador-Ramirez MD. 2002. Critical period of weed control in transplanted chilli pepper. Journal of Weed Research **42,** 203-209.

Amador Ramirez MD, Mojarro Davila F, Velasquez-Valle R. 2007. Efficacy and economics of weed control for dry chili pepper. Journal of Crop Protection **26,** 677-682.

Batal KM, Smittle DA. 1981. Response of bell pepper to irrigation, nitrogen and plant population. Journal of American Society and Horticultural Science **106,** 259-262.

Bosland PW. 1992. Chillies a diverse crop. Horticulture Technology **2,** 7-10.

Chalfant RB, Jaworski CA, Johnson AW, Sumner NR. 1977. Reflective film mulches, millet barriers, and pesticides: Effects on watermelon mosaic virus, insects, nematodes, soil borne fungi, and yield of yellow summer squash. Journal of American Society and Horticultural Science **102,** 11-15.

Dennis RD, Michael JK, Patrick GH. 1989. Mulch surface color affects yield of fresh market tomatoes. Journal of American Society and Horticultural Science **114,** 217-219.

Fathi G, Ebrahimpoor F, Siadat SA. 2003. Efficiency of single and integrated methods (chemical-mechanical) for weed control in Corn SC704 in Ahvaz climatic conditions. Iranian Journal of Agricultural Science and Technology **34,** 187-197.

Frusciante L,Carli P, Maria R, Ercolano S,Pernice R, Matteo AD, Fogliano V, Pellegrini N. 2007. Antioxidant nutritional quality of tomato. Molecular Nutrition and Food Research **51,** 609-617.

George S, Jatoi SA, Siddiqui SU. 2013. Genotypic differences against PEG simulated drought stress in tomato. Pakistan Journal of Botany **45,** 1551-1556.

Govindra S, Bhan VM, Tripathi SS. 1986. Effect of herbicide alone and combination with weeding on tomato and association with weeds. Indian Journal of Weed Science **16,** 262-266.

Gul B, Marwat KB, Saeed M, Hussain Z. 2011.Impact of tillage, plant population and mulches on weed management and grain yield of maize. Pakistan Journal of Botany **43,** 1603-1606.

Hallberg GR. 1989. Pesticide pollution of ground water in the humid United States. Agriculture Ecosystem and Environment **26,** 299-367.

Hassan AA, Ahmed MKA. 2005. The influence of some herbicides and additional hoeing in maize growth and yield and yield components. International Journal of Agriculture and Biology 7, 708-711.

Isik D, Kaya E, Ngouajio M, Mennan H. 2009. Weed suppression in organic pepper *(Capsicum annum* L.) with winter cover crops. Crop Protection **28,** 356-363.

Khan SA, Hussain N, Khan IA, Khan M, Iqbal M. 1998. Study on weeds control in maize. Sarhad Journal of Agriculture **14,** 581- 586.

Kulvinder S, Srivastava BK, Singh KS. 1990. Effect of various levels of nitrogen and phosphorus on growth and yield of chilli. Indian Journal of Horticulture **45,** 319-324.

Locassio SJF, Kell GA, Martin FG. 1981. Response of Bell pepper to nitrogen source. Journal of American Society and Horticultural Science **106,** 625-632.

Mamolos AP, Kalburtji KL. 2001. Competition between Canada thistle and winter wheat. Weed Science **49**, 755-759.

Marana J, Gongora R, Paredes E, Labrada R. 1986. Critical period of competition from weeds in direct sown tomatoes. Horticulture Science **2,** 73-83.

Mavengahama S, Ogunlela VB, Mariga DIK. 2003. Response of paprika *(Capsicum annuum* L.) to different basal fertilizers. African Crop Science Conference Proceedings **6,** 9-13.

Mishra GN. 2000. Crop weed competition under varying densities of jungle rice (*Echinochloa colona*) in upland rice. Indian Journal of Agricultural Sciences **70,** 215-217.

Monks CD, Monks DW, Basden T, Selders A, Poland S, Rayburn E. 1997. Soil temperature, soil moisture, weed control, and tomato (*Lycopersicon esculentum*) response to mulching. Weed Technology **11,** 561-566.

Mudarres AM, Dijak M, Hamilton RI, Dwyer LM. 1998. Leafy reduced stature maize hybrid response to plant population density and planting patterns in a short growing season area. Weed Technology **43,** 227-234.

Payero JO, Bhangoo MS. 1990. Nitrogen fertilizer management practices to enhance seed production by 'Anaheim Chili' peppers. Journal of American Society and Horticultural Science **115,** 245-251.

Peck NH, Mac Donald GE. 1975. Plant response to concentrated superphosphate KCl fertilizer for sweat corn *(Zea mays* L.) var. *rugosa*. New York State Experimental Station Search **2,** 1-8.

Rao VS. 2000. Harmful effects caused by weeds. Principles of Weed Science.Oxford and IBH publishing Co. Pvt. Ltd.New Delhi & Calcutta.1 P.

Saccol AV, Estefanel V. 1995. Competition between barnyard grass and soybean cultivated in hydromorphic soil.Effect on some agronomic characteristics. Pesquisa Agropecuaria Brasileira **30,** 327-338.

Shadbolt CA, HolmLB. 1956. Effect of weed on several vegetable crops. Weeds **4**, 111-123.

Shaikh MA, Saleem A, Malik NA, Shahzad MA. 2004. Assessment of weed complex in spring potato fields of Mix- Cropping system under irrigated conditions of Faisalabad District. Pakistan Journal of Weed Science Research **10,** 63-72.

Shamim F, Johnson GN, Saqlan SM, Waheed A. 2013. Higher antioxidant capacity protects photosynthetic activities as revealed by *Chla fluorescence* in drought tolerant tomato genotypes. Pakistan Journalof Botany **45,** 1631-1642.

Siborlabane C. 2000. Effect of mulching on yield and Quality on Fresh Market Tomato. Pages 1-5. *In:* Training Report 2000. Training Course in Vegetable Production and Research. ARC-AVRDC. Nakhon Pathom, Thailand.

Smith PG, Vilalon B, Vila PL. 1987. Horticultural classification of pepper grown in United States. Horticulture Science 22, 11-13.

Sobkowicz P, Tendziagolska E. 2005. Competition and productivity in mixture of oats and wheat. Journal of Agronomy and Crop Science **191,** 377-385.

Sprague MA. 1986. Overview. *In:* Sprague, M.A., Triplett, G.B. (Eds.), No Tillage and Surface Tillage Agriculture. Wiley, New York, 1-18.

Steel RGD, Torrie JH. 1980. Principles and procedures of statistics. A biometrical approach.2nd Editon. McGraw Hill, Inc. USA.

Syawal Y. 1998. Composition shift and other characteristics of weeds and yield of sweet corn on Andisols with N fertilization and weeding at critical period of the crop. Publikasi Berkala Penelitian Pascasarjana University Padjadjaran. **9,** 18-33.

Unger J, Ackermann R. 1992. Structure, dynamics and competitive effects of a natural weed community during the change of conventional to conservation tillage in maize production of the Leipzig lowland. Zeitschriftfuer Pflanzenkrankheiten Pflanzenschutz. **13,** 277-283.

Weber G, Elemo K, Lagoke STO. 1995. Weed communities in intensified cereal-based cropping systems of the northern Guinea savanna. Weed Research **35,** 167-178.

Younesabadi M, Najad AS, Najad ARS, Kashiri HO. 2006. Effect of climatic conditions on weed frequency of wheat fields and comparison of Golestan province cities by cluster analysis. Pakistan Journal of Weed Science and Research 12, 7-12.

Zafar MI, Anwar R, Saleemi AR. 1981. Effectiveness of chemical weed control in maize production. Pakistan Journal of Agricultural Research **2,** 21-23.