

Effect of herbicides and hand weeding on weed control in guava cv. L-49

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Guava (*Psidium guajava* L.), the apple of tropics, belongs to the family Myrtaceae is one of the most popular fruit in India for its nutritive value, high yield, hardy in nature, good processing quality and wide adaptability all over the tropics and subtropics. Although guava grows well in all states of India, Uttar Pradesh is the largest in area and production and Allahabad produces the best quality guava in the country as well as in the world. Weeds in fruit orchard are considered as the unwanted crops which compete with the associated crop for nutrient, light, moisture, space and adversely affected the growth, yield and quality of many plants as well as fruit crops. The use of herbicides in guava orchard to control weeds is a new practice. The conventional method of controlling weeds by manually is becoming more and more expensive due to steep rise in labour wages. The herbicidal method of weed control, which is considered less expensive, is gaining importance. Nishimoto and Yee (1980) at Hawaii and Martinez and Pareira (1984) at Brazil, obtained good control of weeds in guava orchard by application of herbicides. However, there is very little information available regarding the use of herbicides and their effect on the yield and fruit quality of guava in India. Weeds compete with guava at all the stages of development for soil moisture, soil nutrient and light besides harbouring insects, pests and diseases. As guava is considered to be one of the exquisite, nutritionally valuable and remunerative crops and weed is a serious menace to this crop therefore, it is imperative to develop effective control measures of weeds in guava for normal growth and quality fruits production. An attempt therefore, has been undertaken to assess the influence of herbicidal and manual weed management on growth, yield and fruit quality of guava cv. L-49, grown under new alluvial zone of West Bengal.

The experiment was carried out at the Horticulture Research Station, Mondouri, Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal, during the year 2007. The soil of the experimental orchard is sandy loam in nature with soil pH 6.5 – 6.9. Soil depth is sufficient, moderately fertile and having good drainage system. The experime

ntal site was first plough thoroughly followed by proper leveling. Separate blocks were prepared for each treatment. The block size was made at 12m in east – west and 6m in north – south, thus each block

contained two guava plants maintaining a plant spacing of 6m x 6m. Herbicides were applied at second week of April, 2007. Before application of herbicides the area was well cleaned. Following treatments were studied; Glyphosate @ 1.0 lit. a.i./ha (T₁) and @ 0.75 lit. a.i./ha (T₂) as pre – emergence; 2, 4 – D Sodium salt @ 1200 gram a.i./ha (T₃) and @ 1000 gram a.i./ha (T₄) at 30 days after glyphosate application; Glyphosate @ 1.0 liters a.i./ha + 2, 4 – D Sodium salt @ 1200 gram a.i./ha (T₅) and Glyphosate @ 0.75 liters a.i./ha + 2, 4 – D Sodium salt @ 1000 gram a.i./ha (T₆) at 30 days after glyphosate application; Hand weeding or manual weeding at 30 days intervals (T₇) and Control (unweeding) (T₈). Collection of weeds was done at 30 days intervals. All weeds were collected from each block for fresh weight then oven dried at 70°C temperature for 3 days. Subsequently dry weight was taken and ground very finely for estimation of leaf nutrients (nitrogen, phosphorus and potassium). The observations regarding the vegetative growth, flowering- fruiting and physico-chemical characteristics of fruits of guava were taken and analyzed statistically by analysis of variance method in Randomized Block Design as suggested by Panse and Sukhatme (1978).

Following weeds are found in the experimental field-
Monocots : *Cyperus rotundus*, *Cyperus erea*,
Cynodon dactylon, *Sataria glauca*,
and *Echinocloa colonum*.

Dicots : *Commelina bengalensis*, *Phyllanthus niruri*,
Solanum nigrum,
Alternanthera philloxeroides, *Mimosa pudica* and *Ageratum conizoides*.

The periodical record of weed population (number of weeds/m²) is presented in the table-1 and it was found that herbicides and manual weeding reduced the weed number significantly over control. Herbicides also differed significantly in their effects. The minimum number of weeds was found by hand weeding at all the stages of weed collections. However among the chemical herbicides, Glyphosate @ 1.0 liters a.i. / ha + 2,4-D sodium salt @ 1200g a.i / ha at 30 days after glyphosate application (T₅) was found effective in controlling the weeds. The weed count increased significantly after 60 and 90 days of herbicide application, thereby indicated that

effectiveness of herbicides attenuated at 60 and 90 days of spray.

Data (table 1) clearly indicated that application of herbicides and hand weeding showed significant decreased on fresh weight of weeds. Highest fresh weight of the weed [493.33 (30 days), 591.67 (60 days), 644.60 (90 days) and 959.37 (120 days)] were obtained from the control block and it was minimum [27.77 (30 days), 28.87 (60 days), 21.87 (90 days) and 23.17 (120 days) in blocks under hand weeding. Hand weeding also minimized the dry weight [10.4 (30 days), 8.93 (60 days), 6.53 (90 days) and 7.90 (120 days)] of weeds whereas, it was maximum in control block.

Herbicides application and hand weeding also showed significant variation in nutrient content of weeds. Maximum nitrogen (1.36 %), phosphorous (0.226 %) and potassium content (0.47 %) of weed were noted from the control block as compared to lowest with hand weeding (0.90%, 0.145% and 0.31%, respectively) followed by (T₅).

The data on the effect of herbicides on flower drop, fruit set, fruit drop and fruit yield of guava cv. L - 49 have been presented in table-2. The highest flower drop (36.84 %) was noted from the control plants compared to (T₅) (17.87 %). Thus, highest fruit set (82.97%) was recorded by T₅. However, all the weed control treatments recorded higher fruit set over the control and the highest fruit retention (59.64 %) was recorded by hand weeding as compared with only 48.66 % observed in control. Due to higher fruit retention by all the weed management practices, both herbicidal and hand weeding significantly increased the number of fruits (maximum 329 fruits per plant by hand weeding) as well as fruit yield (highest 49.14 kg/plant and 13.66 t/ha under hand weeding) comparing the lowest yield obtained in control plants.

The fruit size showed significant variation due to different herbicides treatments and it was noted that the fruits obtained from the plants under hand weeding treatment produced the fruits with highest fruit length (5.98cm) and diameter (6.17 cm). The minimum sized fruits (5.23 cm length and 5.17 cm in diameter) were observed under control (Table 4). The average fruit weight also showed a significant variation due to different herbicidal treatments (table 4). The maximum fruit weight of 149.41gram was noted from plants under T₅. The minimum fruit weight of 115.20 gram was recorded in control.

Table-4 revealed that all herbicides treatments significantly increased the total soluble solids content of fruits over control. Among herbicides treatments application of glyphosate + 2,4 - D sodium salt (T₅) was most effective in increasing the total soluble solids (8.73 °Brix) content of fruits. The lowest TSS (7.20 °Brix) content was recorded in

fruits which were obtained from unmulched control plants. Weed management also reduced the acidity of fruits and the lowest acidity (0.323 %) of the fruits was noted with the treatment by hand weeding while it was highest (0.383 %) in control. (T₅) significantly increased T.S.S/ Acid ratio (26.63) of fruits over control (Table 4). This treatment was also found effective to improve (T₅) total sugar (6.51 %), reducing (3.82%) and non reducing sugar (2.69%) content of the fruits. Applications of herbicides and hand weeding have significant effect on vitamin-C content of fruits. The highest (147.98mg/100g fruit pulp) vitamin-C content of the fruits was recorded by glyphosate @ 1.0 liters a.i./ha + 2,4-D sodium salt @ 1200 gram a.i./ha at 30 days after glyphosate application, while it was lowest (114.08 mg/ 100g fruit pulp) in control.

The experiments revealed that application of herbicides and hand weeding were effective in controlling weeds as observed from weed population and fresh and dry weight of weeds. The use of herbicides was found effective to control of weeds irrespective of doses of application. But their efficiency declined with the duration after application. It might be due to the fact that the effectiveness of pre-emergence herbicide retain for three to four months (90-100 days). Hand weeding at 30 days interval was found best in controlling the weeds. The effectiveness of hand weeding in reducing the population and growth of weed was due to frequent weeding which hampered the normal growth of weeds. The results on basis of fresh weight, dry weight and foliar N, P, K status clearly showed that hand weeding and combined application of Glyphosate and 2,4-D Sodium salt (T₅) were most effective practice for management of weeds in guava orchard which minimized the crop weed competition.

Another beneficial effect of the treatment was the reduction of fruit drop, which consequently improved the fruit production. Different treatments also showed an improvement in physico-chemical characteristics of fruits *i.e.* fruit weight, fruit size and chemical constituents as compared to unweeded control. This may be due to the fact that weed management practices minimized the population, dry weight of weeds and nutrient uptake was also less by the weeds for which nutrient availability was much more for the main guava crops and ultimately improved the fruit quality. Similar findings were also reported by Kundu *et al.* (1997); Bal *et al.* (2003); Kalyan *et al.* (2004); Bal and Kumar (2005) and Pathak *et al.* (2007) while experimenting in guava.

It is very clear from the study that weed management in guava orchard is beneficial for the overall growth, fruit yield and improvement of quality of fruits. Among the different management practices combined application of glyphosate @ 1.0 lit. a.i./ha

(as pre emergence herbicide) and 2,4-D sodium salt @ 1200 g a.i./ha (as post emergence, applied at 30 days after glyphosate application) has found as the most effective in controlling weeds in guava orchard in respect of overall performances.

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Table 1: Effect of herbicides and hand weeding on weed population, fresh and dry weight.

Treatment	Weed population (no.m ⁻²)				Fresh weight (g.m ⁻²)				Dry weight (g.m ⁻²)			
	30 DAT	60 DAT	90 DAT	120 DAT	30 DAT	60 DAT	90 DAT	120 DAT	30 DAT	60 DAT	90 DAT	120 DAT
T ₁	37.67	76.33	120.67	158.33	72.53	103.23	173.10	217.0	18.93	40.00	52.03	71.27
T ₂	43.67	87.33	131.67	178.33	86.73	109.93	158.23	288.33	35.73	42.80	54.03	91.43
T ₃	73.00	136.00	204.00	274.00	255.53	506.67	580.60	593.90	68.90	114.60	161.33	132.60
T ₄	85.00	166.67	228.33	308.33	324.33	546.73	605.30	603.23	81.40	184.30	200.00	203.60
T ₅	30.00	53.33	84.00	118.33	34.23	62.17	104.57	164.87	10.33	18.90	40.50	55.77
T ₆	39.00	71.33	105.67	126.00	47.53	84.93	112.37	202.07	11.37	23.37	42.63	58.47
T ₇	23.33	29.33	34.67	40.33	27.77	28.87	21.87	23.17	10.40	8.93	6.53	7.90
T ₈	127.67	220.00	309.33	428.	439.33	591.67	644.60	959.37	108.07	203.93	214.63	359.93
SEm (±)	2.270	2.721	3.656	5.470	15.244	8.201	13.220	13.924	4.437	5.481	7.832	17.320
LSD(0.05)	6.68	8.27	11.10	16.60	46.23	24.87	40.09	42.23	13.57	16.62	23.75	52.53

Table 2: Effect of herbicides and hand weeding on N, P and K content of weed flora on dry weight basis

Treatments	Nitrogen (%)	Phosphorous (%)	Potassium (%)
T ₁	1.26	0.170	0.37
T ₂	1.27	0.180	0.39
T ₃	1.30	0.193	0.42
T ₄	1.28	0.193	0.44
T ₅	1.24	0.156	0.35
T ₆	1.26	0.163	0.39
T ₇	0.90	0.145	0.31
T ₈	1.36	0.226	0.47
SEm (±)	0.132	0.135	0.147
LSD(0.05)	N.S	N.S	N.S

Table 3: Effect of herbicides and hand weeding on flowering and fruiting of guava

Treatments	Flower drop (%)	Fruit set (%)	Total fruit drop (%)	Final fruit retention (%)	Number of fruits/plant	Yield (kg/plant)	Yield (t/ha)
T ₁	23.33(28.88)	76.74(61.17)	42.04(40.42)	58.00(49.60)	314.33	43.33	12.05
T ₂	27.73(31.78)	72.24(58.21)	45.85(42.62)	54.44(47.55)	303.33	38.64	10.74
T ₃	30.75(33.68)	71.22(57.56)	48.31(44.03)	51.72(45.99)	281.33	36.65	10.19
T ₄	28.74(32.42)	69.82(56.67)	49.88(44.94)	50.38(45.22)	268.33	37.88	10.53
T ₅	17.87(25.00)	82.97(65.63)	42.16(40.49)	57.89(49.54)	315.00	47.05	13.08
T ₆	19.04(25.87)	81.28(64.37)	45.73(42.55)	54.31(47.47)	309.67	44.31	11.74
T ₇	21.71(27.77)	78.37(62.29)	40.41(39.47)	59.64(50.56)	329.00	49.14	13.66
T ₈	36.84(37.37)	62.72(52.37)	51.38(45.79)	48.66(44.24)	253.67	29.22	8.12
SE.m (±)	0.310	0.274	0.261	0.246	3.535	1.376	0.380
LSD(0.05)	0.38	0.38	0.79	0.75	10.73	4.18	1.16

Figures in the parenthesis indicates the angular transformed values

Table 4: Effect of herbicides and hand weeding on physico-chemical characteristics of fruits of guava

Treatment	Fruit diameter (cm)	Fruit length (cm)	Fruit weight (g)	T.S.S (^o Brix)	Acidity (%)	T.S.S: Acidity	Total sugar (%)	Reducing sugar (%)	Non – reducing sugar (%)	Vitamin C (mg/ 100 g pulp)
T ₁	5.63	5.72	137.81	7.60	0.333	22.79	6.05	3.33	2.72	134.65
T ₂	5.67	5.58	127.33	7.73	0.347	22.42	5.96	3.28	2.68	139.84
T ₃	5.4	5.53	130.53	7.87	0.347	22.71	5.45	3.15	2.30	126.02
T ₄	6.07	5.67	141.24	7.53	0.360	21.18	5.23	3.07	2.16	122.87
T ₅	5.5	5.79	149.41	8.73	0.330	26.63	6.51	3.82	2.69	147.98
T ₆	5.6	5.81	136.58	8.53	0.327	25.73	6.39	3.70	2.69	143.39
T ₇	6.17	5.98	147.2	8.20	0.323	25.52	6.09	3.58	2.51	142.92
T ₈	5.17	5.23	115.2	7.20	0.383	18.80	5.06	2.98	2.08	114.08
SE.m (±)	0.188	0.177	5.326	0.201	0.009	0.900	0.044	0.025	0.038	1.582
LSD(0.05)	0.57	NS	16.16	0.61	0.29	2.73	0.14	0.08	0.12	4.80

- T₁ : Glyphosate @ 1.0 lit. a.i/ha as pre – emergence
- T₂ : Glyphosate @ 0.75 lit. a.i/ha as pre – emergence
- T₃ : 2,4-D Sodium salt @ 1200 gram a.i./ha at 30 days after glyphosate application
- T₄ : 2,4-D Sodium salt @ 1000 gram a.i./ha at 30 days after glyphosate application
- T₅ : Glyphosate @ 1.0 lit. a.i./ha + 2,4-D Sodium salt @ 1200 gram a.i/ha at 30 days after glyphosate application
- T₆ : Glyphosate @ 0.75 liters a.i./ha + 2,4-D Sodium salt @ 1000 gram a.i/ha at 30 days after glyphosate application
- T₇ : Hand weeding or manual weeding at 30 days intervals
- T₈ : Control (unweeding).