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Repeated application of herbicide mixtures effect on weeds

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Abstract

The experiment was conducted at research farm of the Department of Horticulture, CCS Haryana Agricultural University, Hisar during the year 2016 to assess the effect of repeated application of herbicides on yield of Kinnow. Weeds exert their competition for light, water, nutrients and interfere with other operational factors and also form potential breeding niche for various insect, pest and diseases which affect the plant growth and ultimately the yield. The treatments comprising eleven levels viz., control, spray of glyphosate (1%) + pendimethalin (1 kg/ha) in April, spray of paraquat (0.6%) + pendimethalin (1 kg/ha) in April, Spray of glyphosate (1%) + pendimethalin (1 kg/ha) in April and June, spray of paraquat (0.6% + pendimethalin (1 kg/ha) in April and June, spray of glyphosate (1%) + pendimethalin (1 kg/ha) in April, June and August, spray of paraquat (0.6%) + pendimethalin (1 kg/ha) in April, June and August, spray of glyphosate (1%) + pendimethalin (1 kg/ha) in April, June, August and October, spray of paraquat (0.6%) + pendimethalin (1 kg/ha) in April, June, August and October, Mechanical weeding in April and August and Mechanical weeding in April, July and September which were laid out in a randomized block design. The maximum visual mortality of weeds at 60, 120 and 180 DAT and least weed density, fresh weight of weeds and dry weight of weeds was registered with the treatment glyphosate 1% + pendimethalin 1kg/ha in April, June, August and October at all intervals.

Keywords: Kinnow, mechanical, mortality, weeds and yield

Introduction

In India, Kinnow is being grown in Haryana, Punjab, Rajasthan, Himachal Pradesh, Jammu and Kashmir and Uttar Pradesh. Its trees are highly productive. The climate of sub-tropical region is very favorable for seeds germination and rapid growth of weeds like *Cyperus rotundus*, *Cynodon dactylon*, *Chenopodium album*, *Sorghum halepense*, *Parthenium terophorus*, *Cannabis sativa*, *Chenopodium album*, *Rumex dentalis*, *Anagalis arvensis* and *Phalaris minor* etc (Boora *et al.*, 2014) [2]. Weeds exert their competition for light, water, nutrients and interfere with other operational factors. Weed control has been a major challenge to the growers because of increasing labour and production costs. Chemical weed control in horticulture has become an established practice throughout the leading fruit growing countries of the world.

Materials and methods

The present study of was carried out on four years old Kinnow trees at experimental orchard of Department of Horticulture, CCS Haryana Agricultural University, Hisar during the year 2016 and data were collected on various parameters. The experimental treatments were laid out in randomized block design with eleven herbicide treatments viz., control, spray of glyphosate (1%) + pendimethalin (1 kg/ha) in April, spray of paraquat (0.6%) + pendimethalin (1 kg/ha) in April, Spray of glyphosate (1%) + pendimethalin (1 kg/ha) in April and June, spray of paraquat (0.6% + pendimethalin (1 kg/ha) in April and June, spray of glyphosate (1%) + pendimethalin (1 kg/ha) in April, June and August, spray of paraquat (0.6%) + pendimethalin (1 kg/ha) in April, June and August, spray of glyphosate (1%) + pendimethalin (1 kg/ha) in April, June, August and October, spray of paraquat (0.6%) + pendimethalin (1 kg/ha) in April, June, August and October, Mechanical weeding in April and August and Mechanical weeding in April, July and September and each were tried on uniformly grown tree spaced at 6x6 m.

Weed density of different species per m² at 0, 60, 120 and 180 days of spray and weed population was counted separately for each species and the values were presented as number of weeds per square meter from all treatments in each replication was recorded with the help of 0.5x0.5 m² frame placed randomly under the canopy of tree and the visual mortality was

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recorded at 60,120 and 180 days of spray and expressed in percent respectively. Fresh weight of the weeds was recorded just after removal on top pan electric balance and expressed in gram (g). The dry weight of weeds was taken after drying the

weeds in oven at 60°C for 48 hours or until the constant weight was obtained and expressed in gram (g).

Results and discussion

Visual mortality (%)

Table 1: Effect of repeated application of herbicides on visual mortality of weeds under canopy of Kinnow plants

Treatments	Visual mortality %		
	60 Days	120 Days	180 Days
T ₁ : Glyphosate 1% + pendimethalin 1 kg/ha in April	80.00	41.00	12.66
T ₂ : Paraquat 0.6% + pendimethalin 1 kg/ha in April	71.00	12.66	0.00
T ₃ : Glyphosate 1% + pendimethalin 1 kg/ha in April and June	95.33	76.00	26.33
T ₄ : Paraquat 0.6% + pendimethalin 1 kg/ha in April and June	84.33	60.33	16.66
T ₅ : Glyphosate 1% + pendimethalin 1 kg/ha in April, June and August	95.00	91.00	73.66
T ₆ : Paraquat 0.6% + pendimethalin 1 kg/ha in April, June and August	89.33	85.66	63.33
T ₇ : Glyphosate 1% + pendimethalin 1 kg/ha in April, June, August and October	90.66	94.66	89.00
T ₈ : Paraquat 0.6% + pendimethalin 1 kg/ha in April, June, August and October	88.33	85.33	80.66
T ₉ : Mechanical weeding in April and August	52.33	70.33	40.33
T ₁₀ : Mechanical weeding in April, July and September	54.33	67.66	74.33
T ₁₁ : Control	0.00	0.00	0.00
SE(m) ±	1.95	1.31	1.41
C.D. at 5% level of significance	5.79	3.98	4.20

The data in Table I reveal that the maximum visual mortality (95.33%) at 60 DAT among the herbicidal treatments, was observed with glyphosate 1%+ pendimethalin 1 kg/ha in April and June and minimum in control while the maximum visual mortality (94.66%) at 120 DAT was recorded in glyphosate 1%+ pendimethalin 1 kg/ha in April, June, August and October and minimum in control and at 180 DAT maximum visual mortality (89.00%) was observed in glyphosate 1%+pendimethalin 1 kg/ha in April, June, August and October and minimum in control. Glyphosate inhibits 5-enolpyruvylshikimate-3-phosphate synthase (EPSPS; E.C. 2.5.1.19). Inhibition of EPSPS results in an accumulation of

shikimate-3-phosphate, ultimately leading to a block in the production of aromatic amino acids with resultant effects on protein synthesis (Baylis, 2000) ^[1]. These results are in conformity with the findings of Singh and Singh (2004) ^[6] in citrus and Ramteke *et al.* (2013) ^[5] in grapes.

Weed density (weeds m⁻²)

The maximum weed density at 60, 120 and 180 DAT (157.3, 185.7 and 207.7 m⁻²) was recorded in control (weedy check) and the minimum weed density in treatment glyphosate 1% + pendimethalin 1 kg/ha in April, June, August and October (7.0, 8.3 and 7.0 m⁻² at each stage), respectively.

Table 2: Effect of repeated application of herbicides on weed density (weeds m⁻²) under canopy of Kinnow plants

Treatments	Number of weeds/m ²			
	0 Days	60 Days	120 Days	180 Days
T ₁ :Glyphosate 1% + pendimethalin 1 kg/ha in April	124.3(11.9)	23.0(4.9)	75.3(8.7)	100.7(10.1)
T ₂ :Paraquat 0.6% + pendimethalin 1 kg/ha in April	128.0(11.4)	40.3(6.4)	107.7(10.2)	119.7(11.0)
T ₃ :Glyphosate 1% + pendimethalin 1 kg/ha in April and June	127.0(11.3)	10.0(3.3)	26.7(5.3)	91.7(19.6)
T ₄ :Paraquat 0.6% + pendimethalin 1 kg/ha in April and June	127.0(11.3)	13.7(4.0)	47.3(7.0)	107.3(10.4)
T ₅ :Glyphosate 1% + pendimethalin 1 kg/ha in April, June and August	135.3(11.7)	9.3(3.2)	11.7(3.6)	27.0(5.4)
T ₆ :Paraquat 0.6% + pendimethalin 1 kg/ha in April, June and August	132.7(11.6)	15.0(5.7)	20.7(4.6)	35.7(6.1)
T ₇ :Glyphosate 1% + pendimethalin 1 kg/ha in April, June, Aug. & Oct.	136.7(11.7)	7.0(4.0)	8.3(3.0)	7.0(3.04)
T ₈ :Paraquat 0.6% + pendimethalin 1 kg/ha in April, June, Aug. & Oct.	124.3(11.2)	13.7(3.8)	17.3(4.7)	20.3(4.9)
T ₉ :Mechanical weeding in April and August	135.3(11.7)	57.3(7.7)	24.7(5.1)	77.67(8.9)
T ₁₀ :Mechanical weeding in April, July and September	126.0(11.3)	62.3(8.0)	40.3(6.4)	35.0(6.0)
T ₁₁ :Control	124.3(11.9)	157.3(12.6)	185.7(13.7)	207.7(14.4)
SE(m) ±	-	0.2	0.1	0.1
C.D. at 5% level of significance	NS	0.5	0.4	0.3

The data in parentheses are square root transformed values

Fresh weight of weeds (g/m²)

The maximum fresh weight at 60, 120 and 180 DAT (252.0, 317.3 and 372.3 g/m²) was recorded in control (weedy check),

while the lowest fresh weight at 60, 120 and 180 DAT (13.0, 14.3 and 11.0 g/m²) was recorded with pendimethalin 1 kg/ha + glyphosate 1% treatment, respectively.

Table 3: Effect of repeated application of herbicides on fresh weight of weeds (g m⁻²) under canopy of Kinnow plants

Treatments	Fresh weight of weeds (g/m ²)			
	0 Days	60 Days	120 Days	180 Days
T ₁ :Glyphosate 1% + pendimethalin 1 kg/ha in April	229.0(15.2)	37.7(6.2)	110.3(10.5)	150.7(12.3)
T ₂ :Paraquat 0.6% + pendimethalin 1 kg/ha in April	231.6(15.3)	53.3(7.4)	140.3(11.9)	163.0(12.8)
T ₃ :Glyphosate 1% + pendimethalin 1 kg/ha in April and June	220.3(14.9)	15.0(4.0)	44.3(6.7)	142.7(12.0)
T ₄ :Paraquat 0.6% + pendimethalin 1 kg/ha in April and June	222.7(15.0)	14.0(3.9)	65.0(8.1)	151.3(12.3)
T ₅ :Glyphosate 1% + pendimethalin 1 kg/ha in April, June and August	230.7(15.3)	14.0(3.9)	17.0(4.1)	42.7(6.3)

T ₆ :Paraquat 0.6% + pendimethalin 1 kg/ha in April, June and August	227.7(15.1)	23.3(5.0)	35.7(6.1)	47.0(7.0)
T ₇ :Glyphosate 1% + pendimethalin 1 kg/ha in April, June, Aug. & Oct.	242.0(15.6)	13.0(3.7)	14.3(3.9)	11.0(3.3)
T ₈ :Paraquat 0.6% + pendimethalin 1 kg/ha in April, June, Aug. & Oct.	229.3(15.2)	20.3(4.6)	33.7(5.5)	35.0(6.1)
T ₉ :Mechanical weeding in April and August	230.3(15.2)	83.7(9.2)	40.0(6.4)	111.0(10.6)
T ₁₀ :Mechanical weeding in April, July and September	223.0(15.0)	85.0(9.3)	53.3(7.4)	47.0(6.9)
T ₁₁ :Control	231.3(15.2)	252.0(15.9)	317.3(17.9)	372.3(19.3)
SE(m) ±	-	0.2	0.1	0.1
C.D. at 5% level of significance	NS	0.5	0.3	0.3

The data in parentheses are square root transformed values

Dry weight of weeds (g/m²)

Table 4: Effect of repeated application of herbicides on dry weight of weeds (g m⁻²) under canopy of Kinnow plants

Treatments	Dry weight of weeds(g/m ²)			
	0 Days	60 Days	120 Days	180 Days
T ₁ :Glyphosate 1% + pendimethalin 1 kg/ha in April	56.0(7.5)	10.3(3.5)	30.0(5.6)	40.7(6.5)
T ₂ :Paraquat 0.6% + pendimethalin 1 kg/ha in April	60.3(7.8)	20.3(4.6)	37.7(6.2)	47.3(7.0)
T ₃ :Glyphosate 1% + pendimethalin 1 kg/ha in April and June	52.3(7.3)	4.3(2.3)	12.0(3.6)	36.0(6.1)
T ₄ :Paraquat 0.6% + pendimethalin 1 kg/ha in April and June	51.0(7.2)	5.0(2.4)	18.0(4.4)	40.0(6.4)
T ₅ :Glyphosate 1% + pendimethalin 1 kg/ha in April, June and August	56.7(7.6)	3.7(2.1)	4.3(2.4)	17.3(4.3)
T ₆ :Paraquat 0.6% + pendimethalin 1 kg/ha in April, June and August	56.3(7.5)	7.7(3.0)	14.3(3.9)	22.3(5.0)
T ₇ :Glyphosate 1% + pendimethalin 1 kg/ha in April, June, Aug. & Oct.	60.3(7.4)	3.3(2.1)	4.0(2.2)	4.0(2.2)
T ₈ :Paraquat 0.6% + pendimethalin 1 kg/ha in April, June, Aug. & Oct.	52.7(7.3)	6.3(2.7)	16.7(4.2)	10.3(3.4)
T ₉ :Mechanical weeding in April and August	56.3(7.5)	21.3(4.7)	17.3(4.3)	31.7(5.7)
T ₁₀ :Mechanical weeding in April, July and September	55.3(7.5)	25.3(5.1)	35.0(6.0)	12.0(3.6)
T ₁₁ :Control	55.7(7.5)	68.7(8.3)	100.0(10.0)	120.3(11.0)
SE(m) ±	-	0.1	0.1	0.1
C.D. at 5% level of significance	NS	0.4	0.4	0.4

The data in parentheses are square root transformed values

The maximum dry weight at 60, 120 and 180 DAT (70.0, 87.0 and 109.3 g/m²) was recorded in control (weedy check), respectively and the minimum dry weight (3.3, 4.0 and 4.0 g/m² at each stage) in glyphosate 1% + pendimethalin 1 kg/ha in April, June, August and October treatment. Reduction in dry matter accumulation by weeds in all the herbicidal treatments might be attributed to the fact that herbicides when applied affect different physiological processes of the growing weeds and inhibit weed seed germination and growth (Kaur and Kaundal, 2009)^[4].

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