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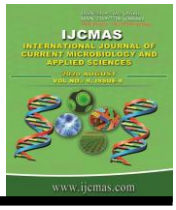

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Effect of Integrated Weed Management on Growth and Yield of Chickpea (*Cicer arietinum* L.) under Irrigated Condition of Punjab

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A B S T R A C T

To investigate the Effect of integrated weed management on growth and yield of chickpea (*Cicer arietinum* L.) under irrigated condition of Punjab a field experiment was conducted during *rabi* season of 2017-18 at the Campus for Agricultural Research and Advanced Studies Dhablan of the G.S.S.D.G.S. Khalsa College Patiala, Punjab. The field experiment was laid out in randomized block design with 10 different treatments with 3 replications. Integrated weed management significantly influenced the growth and yield of chickpea crop. Total weed population (m^{-2}) was recorded significantly minimum in treatment T_2 (Weed free) which was followed by treatment T_4 (Two hand weeding at 25 and 45 DAS) and T_6 (Pendimethalin @ 750g ha^{-1} *fb* one hand weeding at 25 DAS). All the growth parameters like plant height (cm), number of branches $plant^{-1}$, dry weight (g) $plant^{-1}$ and seed yield (q ha^{-1}) was significantly higher in treatment T_2 (Weed free) which was followed by treatment T_4 (Two hand weeding at 25 and 45 DAS) and T_6 (Pendimethalin @ 750g ha^{-1} *fb* one hand weeding at 25 DAS).

Introduction

Chickpea (*Cicer arietinum* L.) is a legume crop which belongs to *fabaceae* family, sub-family *faboideae*. It is commonly known as Gram or Bengal gram (English), Chana (Hindi). Chickpea is mostly used as salad and to cook various dishes. It is a key source of protein and plays an important role in human nutrition. Pulses are highly rich source of protein, carbohydrates, minerals, important vitamins and fiber. These have great importance in the human dietary and in agricultural pulse production. Similar to all other pulses chickpea is also a great source of protein. It contains high level of protein (18-22%), fat (7-10%), carbohydrate (60-65%), minerals (3-5%) and rich in vitamin B and C.

The global production of chick pea is 13.73 million tonnes grown over an area of 13.98 million hectares with productivity 982 kg ha^{-1}. In India, the area under chickpea cultivation is 8.93 million hectares and the production is 8.36 million tonnes with productivity 995 kg ha^{-1} (Directorate of pulses development, DAC&FW 2016-17). India contributes around 70% area and 67% production of world's chickpea.

The main objectives of integrated weed management are to eradicate the unwanted plants and produce the maximum crop production at a lower cost under a given agro-ecosystem. Dependence on a single component of weed management i.e. mechanical weeding (hoeing) as well as on chemicals (weedicides) has their own limitations, so integration of both the component shows to be eco-friendly and most effective technique of weed management.

Yield losses in chickpea crop due to weeds ranges from 22-100%. Bhalla *et al.,* (1998) found that herbicide treatment gave 50-64% weed control with an increase in yield. Poor weed management is one of the most important yield limiting factor in chickpea. So integrated weed management is an important key factor for enhancing the productivity of chickpea. Weeds compete with crop for nutrient, moisture, light and space. Weeds can remove plant nutrients from soil more expeditiously than crops. Integration of lower rates of herbicides and cultural practices look to be best approach as reported by Ali and Nath (1994).

Materials and Methods

The field experiment was laid out in randomized block design with 10 different treatments with 3 replications. The soil of experimental field was clay, soil pH 7.3, medium in organic carbon (0.52%), low in available nitrogen (262 kg ha^{-1}), medium in available phosphorus (22.6 kg ha^{-1}) and potassium (129 kg ha^{-1}).

The plant material comprised of chickpea var. PBG 7 as per treatment was sown on 23th November, 2017 and harvested at 4th April 2018. The crop was planted maintaining a distance of 30 cm and 10 cm between the row and plants respectively. Weed population were counted from a quadrate measuring 1 m^2 from two locations in each plot at 30, 60, 90 DAS and at harvest and was expressed as number of plants m^{-2}. Five representative sample plants were randomly selected from each of the plots plant height was recorded in cm.

The numbers of branches per plant were counted from the five randomly selected sample plants and the values of these were summed up and averaged. To study the dry weight of five plants were collected from the sampling rows of each plot at 30 days interval from sowing till harvest of the crop. Harvested produce from the net plot was threshed manually and grain yield recorded in kilograms. It was then converted to q ha^{-1} by bringing the produce at 14 per cent moisture content.

Results and Discussion

Integrated weed management has significantly effect on weed, growth and yield of chickpea crop. The result of present study showed that significantly lower weed populations (6.33, 7.00, 9.67 and 7.67) were recorded at all the stages of crop growth in the treatment T_2 (Weed free). Among the other weed control treatments, the lowest weed population (No.) m^{-2} (14.33, 15.67, 16.33 and 17.67) were observed under the treatments T_6 (Pendimethalin PE @ 750g ha^{-1} *fb* one hand weeding at 25 DAS), T_{10} (Oxyfluorfen PE @ 100 g ha^{-1} *fb* one hand weeding at 25 DAS), T_3 (One hand weeding at 25 DAS) and T_4 (Two hand weeding at 25 and 45 DAS) respectively at 30 DAS. Whereas at 60, 90 DAS and at harvest treatment T_4 (Two hand weeding at 25 and 45 DAS), recorded minimum number of weeds (9.00, 14.33 and 15.67) respectively as compared to rest of the treatment. This similar finding was also reported by Malik *et al.,* (2005) and Patel *et al.,* (2006) (Fig. 1–4; Table 1–5).

Table.1 Effect of integrated weed management on total weed population (No.) m^{-2} of chickpea

Treatments	Total weed population (No.) m^{-2}			
	30 DAS	**60 DAS**	**90 DAS**	**At harvest**
T_1. Weedy check (Control)	90.33	107.67	130.67	133.67
T_2. Weed free	6.33	7.00	9.67	7.67
T_3. One hand weeding at 25 DAS	16.33	61.33	73.67	89.67
T_4. Two hand weeding at 25 and 45 DAS	17.67	9.00	14.33	15.67
T_5. Pendimethalin PE @ 750g ha^{-1}	35.67	41.33	49.33	54.67
T_6. Pendimethalin PE @ 750g ha^{-1} *fb* one hand weeding at 25 DAS	14.33	15.67	18.33	24.67
T_7. Quizalofop-p-ethyl PoE @40g ha^{-1}	56.67	59.67	66.00	81.00
T_8. Quizalofop-p-ethyl PoE @40g ha^{-1} *fb* one hand weeding at 45 DAS	59.00	36.33	39.67	51.33
T_9. Oxyfluorfen PE @ 100 g ha^{-1}	37.67	45.33	51.67	59.33
T_{10}. Oxyfluorfen PE @ 100 g ha^{-1} *fb* one hand weeding at 25 DAS	15.67	16.67	22.67	29.33
SEm±	**1.19**	**1.33**	**1.06**	**0.89**
CD(0.05)	**3.55**	**3.99**	**3.18**	**2.68**

Table.2 Effect of integrated weed management on plant height (cm) of chickpea

Treatments	Plant height (cm)			
	30 DAS	**60 DAS**	**90 DAS**	**At harvest**
T_1. Weedy check (Control)	6.18	18.94	31.55	36.64
T_2. Weed free	12.12	27.74	48.11	55.49
T_3. One hand weeding at 25 DAS	10.51	21.97	42.03	49.53
T_4. Two hand weeding at 25 and 45 DAS	10.69	24.96	46.25	54.79
T_5. Pendimethalin PE @ 750g ha $^{-1}$	9.67	22.91	45.11	51.82
T_6. Pendimethalin PE @ 750g ha $^{-1}$ *fb* one hand weeding at 25 DAS	12.01	23.87	45.77	53.06
T_7. Quizalofop-p-ethyl PoE @40g ha $^{-1}$	9.01	21.99	43.27	49.55
T_8. Quizalofop-p-ethyl PoE @40g ha $^{-1}$ *fb* one hand weeding at 45 DAS	8.86	23.28	44.67	51.88
T_9. Oxyfluorfen PE @ 100 g ha $^{-1}$	9.54	22.64	43.66	50.17
T_{10}. Oxyfluorfen PE @ 100 g ha $^{-1}$ *fb* one hand weeding at 25 DAS	11.76	23.34	45.04	52.48
SEm±	**0.32**	**0.86**	**0.84**	**0.60**
CD(0.05)	**0.96**	**2.60**	**2.53**	**1.78**

Table.3 Effect of integrated weed management on number of branches plant^{-1} of chickpea

Treatments	Number of branches plant^{-1}			
	30 DAS	**60 DAS**	**90 DAS**	**At harvest**
T_1. Weedy check (Control)	5.99	9.12	15.61	18.16
T_2. Weed free	9.95	16.91	23.74	27.61
T_3. One hand weeding at 25 DAS	9.18	12.94	17.91	21.67
T_4. Two hand weeding at 25 and 45 DAS	9.10	16.43	23.48	27.41
T_5. Pendimethalin PE @ 750g ha $^{-1}$	9.04	15.20	19.41	23.00
T_6. Pendimethalin PE @ 750g ha $^{-1}$ *fb* one hand weeding at 25 DAS	9.74	16.21	22.27	26.74
T_7. Quizalofop-p-ethyl PoE @40g ha $^{-1}$	8.78	13.17	18.86	22.74
T_8. Quizalofop-p-ethyl PoE @40g ha $^{-1}$ *fb* one hand weeding at 45 DAS	8.67	15.32	21.26	25.59
T_9. Oxyfluorfen PE @ 100 g ha $^{-1}$	8.83	13.34	19.28	22.94
T_{10}. Oxyfluorfen PE @ 100 g ha $^{-1}$ *fb* one hand weeding at 25 DAS	9.52	15.79	21.85	25.96
SEm±	**0.25**	**0.31**	**0.38**	**0.40**
CD(0.05)	**0.75**	**0.94**	**1.14**	**1.20**

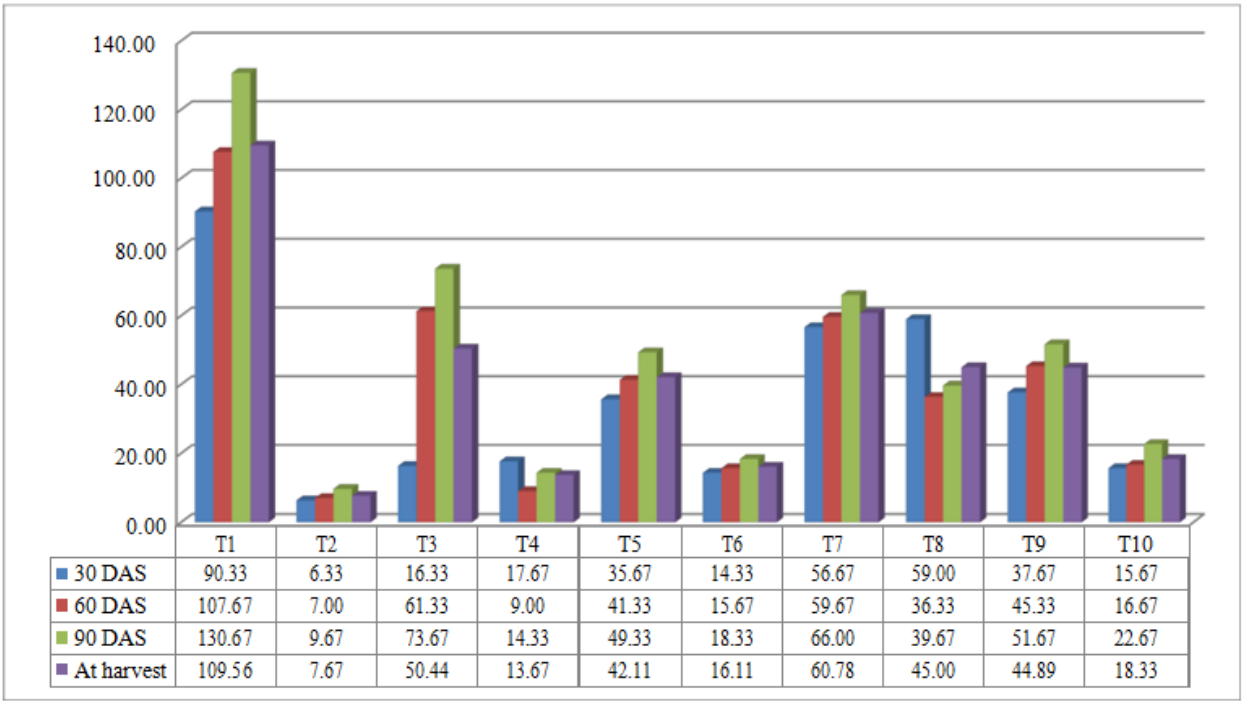
Table.4 Effect of integrated weed management on dry weight (g) plant^{-1} of chickpea

Treatments	Dry weight (g) plant^{-1}			
	30 DAS	60 DAS	90 DAS	At harvest
T_1. Weedy check (Control)	1.23	12.15	17.57	23.13
T_2. Weed free	2.08	15.92	26.72	35.16
T_3. One hand weeding at 25 DAS	1.46	12.44	22.48	29.81
T_4. Two hand weeding at 25 and 45 DAS	1.45	14.85	25.90	34.05
T_5. Pendimethalin PE @ 750g ha^{-1}	1.38	13.63	23.72	32.43
T_6. Pendimethalin PE @ 750g ha^{-1} *fb* one hand weeding at 25 DAS	1.78	14.38	25.68	33.27
T_7. Quizalofop-p-ethyl PoE @40g ha^{-1}	1.34	12.77	22.89	30.35
T_8. Quizalofop-p-ethyl PoE @40g ha^{-1} *fb* one hand weeding at 45 DAS	1.32	13.88	23.86	33.20
T_9. Oxyfluorfen PE @ 100 g ha^{-1}	1.37	13.45	23.58	30.77
T_{10}. Oxyfluorfen PE @ 100 g ha^{-1} *fb* one hand weeding at 25 DAS	1.75	14.28	25.09	32.60
SEm±	**0.11**	**0.52**	**0.40**	**0.39**
CD(0.05)	**0.34**	**1.56**	**1.19**	**1.18**

Table.5 Effect of integrated weed management on seed yield (q ha^{-1})

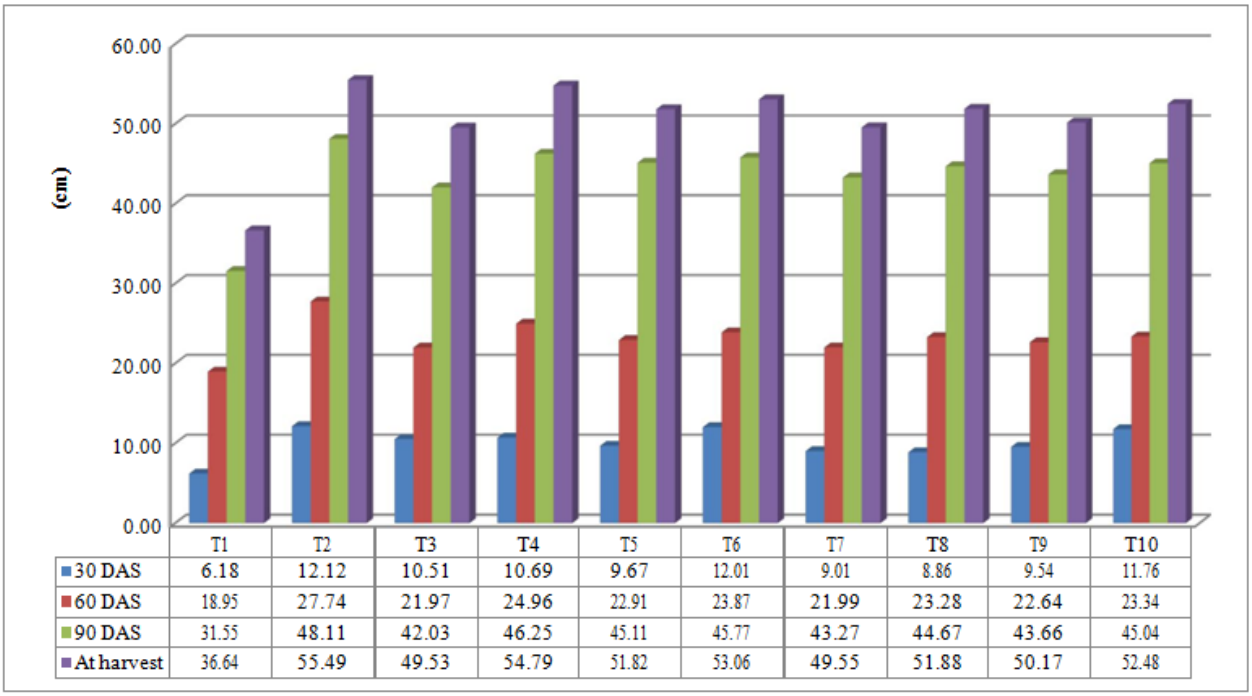
Treatments	Seed yield
T_1. Weedy check (Control)	11.23
T_2. Weed free	19.59
T_3. One hand weeding at 25 DAS	13.23
T_4. Two hand weeding at 25 and 45 DAS	17.99
T_5. Pendimethalin PE @ 750g ha^{-1}	13.67
T_6. Pendimethalin PE @ 750g ha^{-1} *fb* one hand weeding at 25 DAS	17.33
T_7. Quizalofop-p-ethyl PoE @40g ha^{-1}	13.26
T_8. Quizalofop-p-ethyl PoE @40g ha^{-1} *fb* one hand weeding at 45 DAS	14.97
T_9. Oxyfluorfen PE @ 100 g ha^{-1}	13.66
T_{10}. Oxyfluorfen PE @ 100 g ha^{-1} *fb* one hand weeding at 25 DAS	16.63
SEm±	**0.28**
CD(0.05)	**0.85**

Fig.1 Effect of integrated weed management on total weed population (No.) m^{-2} of chickpea



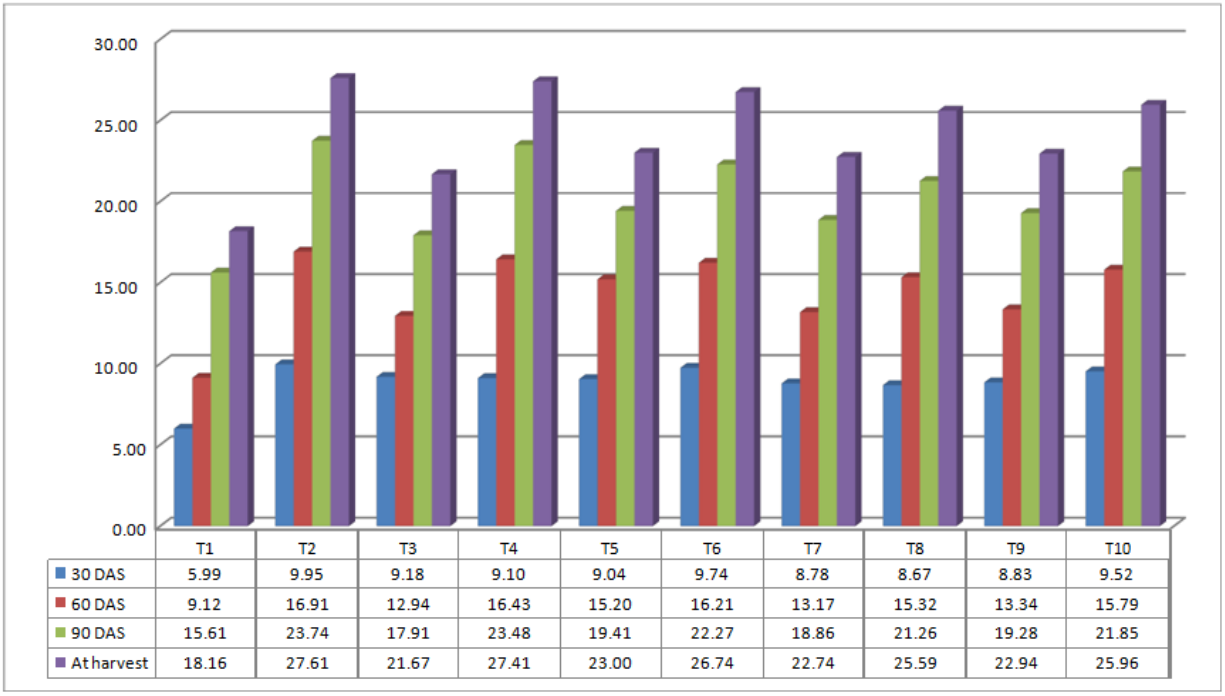
	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
30 DAS	90.33	6.33	16.33	17.67	35.67	14.33	56.67	59.00	37.67	15.67
60 DAS	107.67	7.00	61.33	9.00	41.33	15.67	59.67	36.33	45.33	16.67
90 DAS	130.67	9.67	73.67	14.33	49.33	18.33	66.00	39.67	51.67	22.67
At harvest	109.56	7.67	50.44	13.67	42.11	16.11	60.78	45.00	44.89	18.33

Fig.2 Effect of integrated weed management on plant height (cm) of chickpea



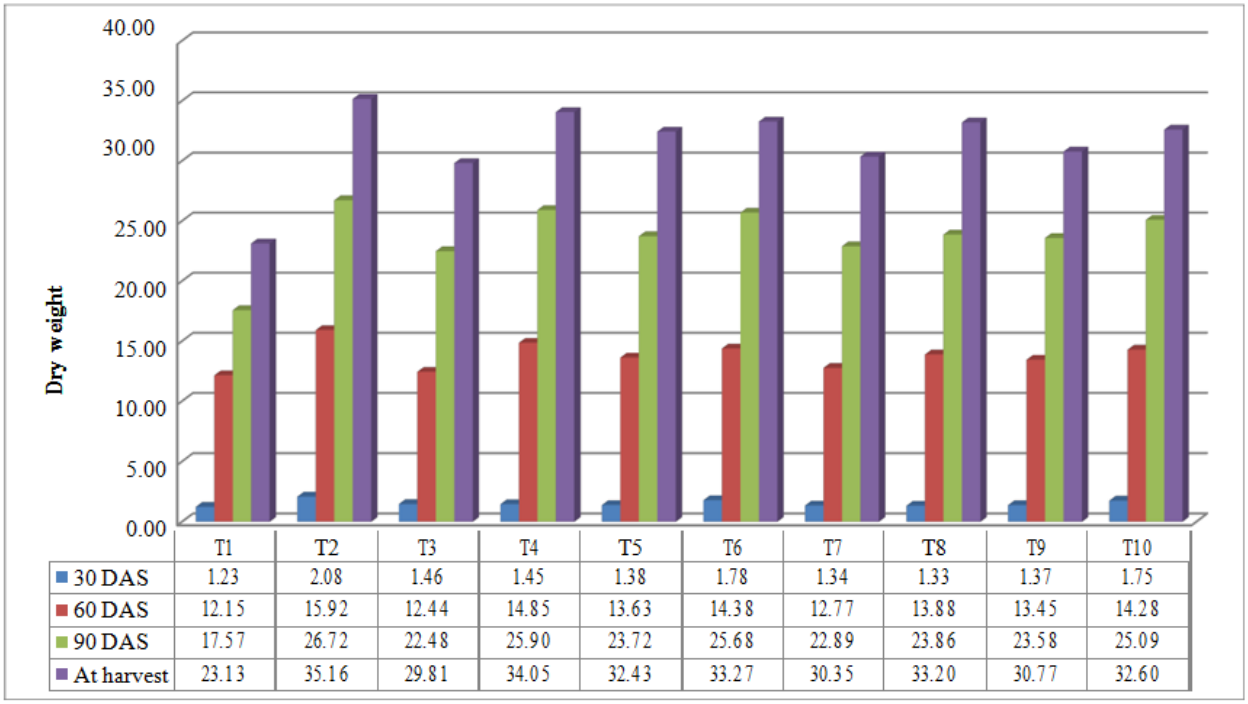
	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
30 DAS	6.18	12.12	10.51	10.69	9.67	12.01	9.01	8.86	9.54	11.76
60 DAS	18.95	27.74	21.97	24.96	22.91	23.87	21.99	23.28	22.64	23.34
90 DAS	31.55	48.11	42.03	46.25	45.11	45.77	43.27	44.67	43.66	45.04
At harvest	36.64	55.49	49.53	54.79	51.82	53.06	49.55	51.88	50.17	52.48

Fig.3 Effect of integrated weed management on number of branches plant^{-1} of chickpea



	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
30 DAS	5.99	9.95	9.18	9.10	9.04	9.74	8.78	8.67	8.83	9.52
60 DAS	9.12	16.91	12.94	16.43	15.20	16.21	13.17	15.32	13.34	15.79
90 DAS	15.61	23.74	17.91	23.48	19.41	22.27	18.86	21.26	19.28	21.85
At harvest	18.16	27.61	21.67	27.41	23.00	26.74	22.74	25.59	22.94	25.96

Fig.4 Effect of integrated weed management on dry weight (g) plant^{-1} of chickpea



	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
30 DAS	1.23	2.08	1.46	1.45	1.38	1.78	1.34	1.33	1.37	1.75
60 DAS	12.15	15.92	12.44	14.85	13.63	14.38	12.77	13.88	13.45	14.28
90 DAS	17.57	26.72	22.48	25.90	23.72	25.68	22.89	23.86	23.58	25.09
At harvest	23.13	35.16	29.81	34.05	32.43	33.27	30.35	33.20	30.77	32.60

The data revealed that the plant height increased significantly with integrated weed management. The maximum plant height (12.12, 27.74, 48.11 and 55.49 cm) was recorded in treatment T_2 (Weed free) which was followed by treatment T_4 (Two hand weeding at 25 and 45 DAS) and T_6 (Pendimethalin @ 750g ha^{-1} *fb* one hand weeding at 25 DAS). The favourable response of integrated weed management on highest plant height was also delineated by Aslam *et al.,* (2007) and Singh *et al.,* (2008).

The result of the present study indicates that the number of branches and dry weight plant^{-1} (g) was significantly enhanced with integrated weed management. The highest number of branches (9.95, 12.12, 23.74 and 27.61) and dry weight plant^{-1} (g) (2.08, 15.92, 26.72 and 35.16) was obtained in in treatment T_2 (Weed free) which was followed by treatment T_4 (Two hand weeding at 25 and 45 DAS) and T_6 (Pendimethalin @ 750g ha^{-1} *fb* one hand weeding at 25 DAS). A similar result on number of branches and dry weight plant^{-1} (g) was also found by Patel *et al.,* (2006) and Singh *et al.,* (2008).

Seed yield (q ha^{-1}) of chickpea varied significantly among various weed management treatments. Treatment T_2 was significantly enhance the seed yield and commodity value of chickpea. The maximum seed yield (19.59 q ha^{-1}) was obtained under the treatment T_2 (Weed free). This similar finding was also reported by Chaudhary *et al.,* (2005) and Pooniya *et al.,* (2009).

In conclusion on the basis of the results from the present investigation, the following conclusion has been drawn:

Weed free and two hand weeding at 25 and 45 DAS was found most effective in minimizing the weed population. Among the other integrated treatments, Pendimethalin PE @ 750g ha^{-1} *fb* one hand weeding at 25 DAS found to be superior over the rest of treatments.

Application of pendimethalin PE @ 750g ha^{-1} *fb* one hand weeding at 25 DAS was found similar to weed free and two hand weeding at 25 and 45 DAS in improving the plant growth and seed yield.

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