Original Research Article

Effect of weed management practices on nutrient content and their uptake by green gram crop (*Vigna radiata* L.)

Abstract

Aims: To study the effect of weed management practices on nutrient content and their uptake by green gram (*Vigna radiata* L.).

Study design: Randomized block design.

Place and duration of study: One-year field experiment at Research Farm, School of Agriculture, Abhilashi University, Chail Chowk, Mandi, (H.P.).

Methodology: The experiment was conducted with three replications and ten treatments *viz.*- T_1 = (Weedy check), T_2= (Weed free), T_3 = (Hand weeding at 20 & 35 DAS), T_4 = [Quizalofop-p-ethyl @ 35.50 g a.i. ha^{-1} (PoE) at 20 DAS], T_5 = [Quizalofop-p-ethyl @ 75.00 g a.i. ha^{-1} (PoE) 20 DAS], T_6 = [Pendimethalin @ 1.00 kg a.i. ha^{-1} (PE)], T_7 = [Pendimethalin @ 1.50 kg a.i. ha^{-1} (PE)], T_8 = [Imazethapyr @ 25.00 g a.i. ha^{-1} (PoE) at 20 DAS], T_9 = [Imazethapyr @ 40.00 g a.i. ha^{-1} (PoE) at 20 DAS] and T_{10} = [Pendimethalin @ 1.00 kg a.i. ha^{-1} (PE) + Imazethapyr @ 75.00 g a.i. ha^{-1} (PoE) at 20 DAS].

Result: Different weed management practices showed non-significant effect on nitrogen, phosphorus and potassium content in grains and straw of the green gram crop, while, the highest content of these nutrients were noted in treatment T_2. The application of treatment T_2 recorded the significantly maximum uptake of nitrogen, phosphorus and potassium uptake by grains, straw and total uptake by green gram crop, which was statistically at par with treatment T_3 and T_{10}. Whereas, the minimum content of nitrogen, phosphorus and potassium along with their uptake by green gram crop was found under treatment T_1.

Conclusion: This field study revealed that various weed management practices did not affected the content of nutrients significantly, however, weed management practices significantly affected the nutrient uptake by grains, straw and total uptake by green gram crop.

Keywords: *Green gram, Pendimethalin, Imazethapyr, Quizalofop-p-ethyl, nutrient content and uptake.*

- **INTRODUCTION**

Green gram is a popular pulse crop which is cultivated in both tropical and subtropical climates. After chickpea, pigeon pea, black gram and green gram, is India's fourth most widely grown pulse crop. Green gram is locally known as mung, mug or mung bean and it is originated from India, considered as the most nutritious among pulses, free from heaviness and flatulence. It is generally grown in rainy (*kharif*) and summer seasons. Besides being rich source of proteins and amino acids, they also maintain soil fertility through the process of nitrogen fixation in symbiotic association with rhizobium bacteria present in their root nodules. Thus, every pulse plant is a mini-fertilizer factory itself **(Jat et al. 2012) [1]**.

The pulses constitute an important group of crops in Indian Agriculture, as they improve physical condition of soil and provide nutritious food and fodder. India has a distinction of being world's largest producers of pulses. Increasing yield of pulse crops should be the top priority to fill up the existing gap in the requirement and availability of pulses. Pulses are generally cultivated on marginal and sub marginal lands of low soil fertility where little attention is paying to adequate fertilization, which has resulted in deterioration of soil health and low crop productivity **(Saravanan et al. 2013) [2]**. Green gram is an important legume of Asian origin **(Tripathi et al. 2012) [3]**, is widely cultivated in various climate and geographical regions of India. It can be grown on a variety of soils and climatic conditions, as it is tolerant to drought (**Malik et al. 2006) [4].**

Mung bean is mainly cultivated in India, China, Iran and USA. Green gram is one of the most important pulse crops in India, ranks third in production **(Rathika et al. 2023) [5]**. It is grown under irrigated, rainfed and rice fallow conditions **(Ramesh and Rathika, 2016) [6]**. Green gram (Vigna radiata L.) production is primarily (90%) concentrated in Asia, in India it is grown in about 4.5 million hectares with the total production of 2.64 million tonnes with a productivity of 629 kg ha^{-1} and contributing 10 % to the total pulse production(**www.indiastat.com, 2020-2021) [7].** Pulses are sown under rice fallow condition in about 2.6 lakh hectares in Tamil Nadu which is 30.8% of the total area under pulses in the state **(Rathika and Ramesh, 2023) [8]**.

Weeds are a major impediment to crop production through their ability to compete for resources and their impact on product quality. In the agroecosystems ideal environmental conditions provided for optimal crop productivity are being exploited by the associated weeds. Weeds are responsible for heavy yield losses in all the crops. Weeds not only cause huge reductions in crop

yields but also increase cost of cultivation, reduce input efficiency, interfere with agricultural operations, impair quality, act as alternate hosts for several insect-pests, diseases, affect aesthetic look of the ecosystem, native biodiversity, as well as affect human and cattle health. Weeds are known to account for nearly one third of the losses due to various biotic stresses. In India, presence of weeds in general reduces crop yields by 31.5 and 22.7% in winter season and 36.5% in summer and *kharif* season and in some cases can cause complete devastation of the crop **(Anonymous, 2012) [9]**.

Weed infestation in mung bean crop is one of the main causes of low yield per hectare against the potential yield in the world. Weeds decreased mung bean yield up to 70% as compared to weed control conditions. Chemical weed control is the easiest and most successful alternative method in crop yields. In *kharif* season, weeds are serious problem due to favorable conditions for their growth. Weed management is also important key factor for enhancing productivity of green gram, as weeds compete for nutrients, water, light and space with crop plants during early growth period. Moreover, besides low yield of crop they increase production cost, harbour insect-pest and plant diseases and reduce quality of farm produce and land value. Critical period for crop -weed competition in green gram is from 15-30 days after sowing **(Singh et al. 1996) [10]**. It is also recognized that a low weed population can be beneficial to the crop as it provides food and habitat for a range of beneficial organisms (**Bueren et al. 2002**) **[11]**. However, the aim of weed management should be to maintain weed population at a manageable level. The full season competition with the weeds in green gram cause yield reduction to the extent of 25-100 % (**Malik et al. 2005**) **[12]**.

Weeds cause severe losses in green gram due to its short stature and may causes losses up to 40-68 per cent. The magnitude of loss as a result of crop weed competition depends on type of weed species associated with crop, their densities and duration of competition with crops. In green gram, weeds are normally controlled by hand weeding. However, hand weeding is laborious, time consuming, costly and tedious. With increase in labor cost and constraints in availability on time, manual weed control is no more an economical in green gram. Pendimethalin, a pre-emergence herbicide is used to control initial flush of weeds in moong since last many years. However, sole application of pendimethalin is not sufficient to control the diverse group of weed flora in moong. Hence, there was an urgent need to sort out a broad-spectrum efficient post-emergence herbicide including Imazethapyr and Imazamox (Pre-mix) for effective control of weeds in *rabi* green gram to optimize productivity **(Tamang et al. 2015) [13]**.

The magnitude of reduction in yield of green gram depends upon the weed flora present, quantum of weed flora and duration of crop-weed competition. The dominating weed flora found in Haryana consisted of *Trianthema portulacastrum, Echinochloa colona, Digera arvensis, Dactyloctenium aegyptium, Cyperus rotundus, Cyperus compressus, Cleome viscosa, Cucumis*

callosus, Tribulus terresteris, Corchorus tridens, Chorchorus aestuans **(Anonymous, 2011) [14]**. No doubt, cultural as well as mechanical practices such as hand weeding and intercultural are effective but unavailability of labour and continuous rainfall in rainy season does not permit to remove weeds timely. Chemical weed control is other option which is cheaper and provides effective control of weeds. Current trends and further development of intensive agriculture likely to seek help of herbicides as an effective tool for weed control and replacing conventional methods of weed management. Application of pendimethalin as pre-emergence @ 1.5 kg ha' + HW (Hand Weeding) at 30 DAS produced significantly higher grain yield as compared to pendimethalin @ 1.5 kg ha^{-1} or HW 30 DAS alone in controlling weeds in green gram (**Kumar et al., 2004**) **[15]**. Now a day, post emergence herbicides are also available and application of imazethapyr @ 75 & 100 g ha^{-1} at 15-25 days after sowing gives good control of weeds in green gram (**Singh et al., 2014**) **[16].**

- **Materials and Methods**

The experiment was carried out at Research Farm of School of Agriculture, Abhilashi University, Chail Chowk, Mandi (H.P) during the *kharif* of 2023. The experimental farm is situated at 30^0 32' N latitude and 74^0 53'E longitude, with an elevation of 1391 m above mean sea level. The pH of the experimental field was slightly acidic in reaction (5.43) with electrical conductivity of 0.005 dS m^{-1}, high in organic carbon (0.87%), medium in nitrogen (248.77 kg ha^{-1}), medium in phosphorus (22.95 kg ha^{-1}) and medium in potassium (271.44 kg ha^{-1}). The experiment was laid out in a randomized block design (RBD) with ten treatments and three replications. The treatments were used in experiment were- T_1 = (Weedy check), T_2 = (Weed free), T_3 =(Hand weeding at 20 & 35 DAS), T_4 = [Quizalofop-p-ethyl @ 35.50 g a.i. ha^{-1} (PoE) at 20 DAS], T_5 = [Quizalofop-p-ethyl @ 75.00 g a.i. ha^{-1} (PoE) 20 DAS], T_6 = [Pendimethalin @ 1.00 kg a.i. ha^{-1} (PE)], T_7 = [Pendimethalin @ 1.50 kg a.i. ha^{-1} (PE)], T_8 = [Imazethapyr @ 25.00 g a.i. ha^{-1} (PoE) at 20 DAS], T_9 = [Imazethapyr @ 40.00 g a.i. ha^{-1} (PoE) at 20 DAS] and T_{10} = [Pendimethalin @ 1.00 kg a.i. ha^{-1} (PE) + Imazethapyr @ 75.00 g a.i. ha^{-1} (PoE) at 20 DAS]. The recommended doses of nitrogen, phosphorous and potassium was 25:50:25 kg ha^{-1} which was applied through Urea, DAP and MOP. The various herbicidal application was done according to the treatments. The application of herbicides was done with the knapsack sprayer using 500 L ha^{-1} of water solution. Hand weeding was done by removing the weeds manually with the help of khurpi. In case of weedy check treatments, weeds were allowed to grow freely in that plots and in weed free plots weeds were always removed from plot. After the harvest of the crop, the samples of the crop plant were collected from every plot and were cleaned and dried under the shade. After the drying of the samples under shade, the samples were oven-dried at 60 ± 2°C for 24 to 48 hours until their weight was constant and then samples were finely powdered with a mixer grinder. After the grinding process, the samples were used for the analysis of nitrogen,

phosphorous and potassium content in grains and straw of green gram crop. The Kjeldahl digestion and distillation method was used to determine the nitrogen content described by **(Jackson, 1973) [17]**. The venadomolybdate phosphoric yellow color method was used for determining the phosphorus content given by **(Jackson, 1973) [17]**. The flame photometer method was used for determining the potassium content given by **(Jackson, 1973) [17]**. The nitrogen, phosphorous and potassium (kg ha^{-1}) uptake by grains and straw of green gram crop in each treatment was calculated by multiplying the nitrogen, phosphorous and potassium content (%) with yields of grains and straw (q ha^{-1}). The total uptake of different nutrients was calculated after summing their uptake by grain and straw of green gram crop.

3. RESULTS

3.1 Nitrogen (N) content (%) and uptake (kg ha^{-1})

The perusal of data on nitrogen content in grains and straw and their uptake by grains and straw as well as their total uptake by green gram crop are presented in Table-1 and shown in Fig.-1. The study of the data revealed that significant difference was not observed in the content of nitrogen in grains and straw of green gram due to different treatments of weed management practices. However, the treatment T_2 (Weed free) recorded the highest nitrogen content in grains (3.27%) and straw (1.78 %) of green gram, while, treatment T_1 (Weedy check) noted the lowest nitrogen content in grains (3.11 %) and (1.62 %) in straw of green gram crop.

Further analysis of data showed that there is significant effect of different weed management practices on uptake of the nitrogen by green gram crop. The application of treatment T_2 (Weed free) recorded the maximum nitrogen uptake by grains (41.49 kg ha^{-1}), straw (22.54 kg ha^{-1}), as well as total uptake of nitrogen (64.03 kg ha^{-1}) by green gram crop, which was statistically on par with treatments T_3 (Hand weeding at 20 & 35 DAS) and T_{10} [Pendimethalin @ 1.00 kg a.i. ha^{-1} (PE) + Imazethapyr @ 75.00 g a.i. ha^{-1} (PoE) at 20 DAS]. Whereas treatment T_1 (Weedy check) noted the lowest nitrogen uptake by grains (13.47 kg ha^{-1}), straw (7.01 kg ha^{-1}) as well as total uptake of nitrogen (20.48 kg ha^{-1}) by green gram crop during the field experiment.

Table-1 Effect of weed management practices on nitrogen content (%) and their uptake (kg ha^{-1}) by green gram crop

S.N.	Treatments	Nitrogen content (%)		Nitrogen uptake (kg ha^{-1})		
		Grain	Straw	Grain	Straw	Total

T_1	Weedy check	3.11	1.62	13.47	7.01	20.48
T_2	Weed free	3.27	1.78	41.49	22.54	64.03
T_3	Hand weeding at 20 & 35 DAS	3.25	1.77	37.35	20.30	57.66
T_4	Quizalofop-p-ethyl @ 35.50 g a.i. ha^{-1} (PoE) at 20 DAS	3.17	1.67	22.36	13.11	34.14
T_5	Quizalofop-p-ethyl @ 75.00 g a.i. ha^{-1} (PoE) at 20 DAS	3.17	1.67	24.72	13.05	37.76
T_6	Pendimethalin @ 1.00 kg a.i. ha^{-1} (PE)	3.21	1.72	30.78	16.49	47.28
T_7	Pendimethalin @ 1.50 kg a.i. ha^{-1} (PE)	3.22	1.73	33.21	17.88	51.09
T_8	Imazethapyr @ 25.00 g a.i. ha^{-1} (PoE) at 20 DAS	3.19	1.69	27.16	14.40	41.57
T_9	Imazethapyr @ 40.00 g a.i. ha^{-1} (PoE) at 20 DAS	3.19	1.70	28.23	15.06	43.29
T_{10}	Pendimethalin @ 1.00 kg a.i ha^{-1} (PE) + Imazethapyr @ 75.00 g a.i ha^{-1} (PoE) at 20 DAS	3.24	1.75	35.55	19.20	54.76
	SEm±	***0.12***	***0.06***	***2.07***	***1.14***	***4.07***
	CD at `5%	***NS***	***NS***	***6.19***	***3.42***	***2.20***

Fig- 1 Effect of weed management practices on nitrogen content (%) and their uptake (kg ha^{-1}) of green gram crop

3.2 Phosphorus (P) content (%) and uptake (kg ha^{-1})

The data regarding to the phosphorus content in grains and straw and their uptake by grains and straw as well as their total uptake by green gram crop are presented in Table-2 and shown in Fig.-2. The perusal of the data revealed that there is non-significant difference in the content of phosphorus in grains and straw of green gram due to application of different weed management practices. Whereas, the treatment T_2 (Weed free) recorded the highest content of phosphorus in grains (0.38%) and straw (0.23 %) of green gram crop, however, minimum phosphorus content was observed under treatment T_1 (Weedy check) in grains (0.24 %) and (0.16 %) in straw of green gram crop.

Table-2 Effect of weed management practices on phosphorous content (%) and their uptake (kg ha^{-1}) by green gram crop

S.N.	Treatments	phosphorous content (%)		phosphorous uptake (kg ha^{-1})		
		Grain	Straw	Grain	Straw	Total
T_1	Weedy check	0.24	0.16	1.04	0.69	1.73
T_2	Weed free	0.38	0.23	4.82	2.88	7.70
T_3	Hand weeding at 20 & 35 DAS	0.35	0.22	3.98	2.53	6.51
T_4	Quizalofop-p-ethyl @ 35.50 g a.i. ha^{-1} (PoE) at 20 DAS	0.26	0.17	1.83	1.20	3.03
T_5	Quizalofop-p-ethyl @ 75.00 g a.i. ha^{-1} (PoE) at 20 DAS	0.27	0.18	2.08	1.40	3.48
T_6	Pendimethalin @ 1.00 kg a.i. ha^{-1} (PE)	0.29	0.19	2.78	1.82	4.60
T_7	Pendimethalin @ 1.50 kg a.i. ha^{-1} (PE)	0.30	0.20	3.09	2.06	5.16
T_8	Imazethapyr @ 25.00 g a.i. ha^{-1} (PoE) at 20 DAS	0.27	0.18	2.30	1.53	3.84
T_9	Imazethapyr @ 40.00 g a.i. ha^{-1} (PoE) at 20 DAS	0.29	0.20	2.56	1.74	4.30
T_{10}	Pendimethalin @ 1.00 kg a.i ha^{-1} (PE) + Imazethapyr @ 75.00 g a.i ha^{-1} (PoE) at 20 DAS	0.34	0.20	3.73	2.19	5.93
	SEm±	***0.03***	***0.02***	***0.39***	***0.24***	***0.69***
	C.D at 5%	***NS***	***NS***	***1.18***	***0.73***	***2.08***

The analysis of data observed that there is significant effect of different weed management practices on uptake of the phosphorus by green gram crop. The application of treatment T_2 (Weed free) recorded the maximum phosphorus uptake by grains (4.82 kg ha^{-1}), straw (2.88 kg ha^{-1}), as well as total uptake of phosphorus (7.70 kg ha^{-1}) by green gram crop, which was statistically on par with treatments T_3 (Hand weeding at 20 & 35 DAS) and T_{10} [Pendimethalin @ 1.00 kg a.i. ha^{-1} (PE) + Imazethapyr @ 75.00 g a.i. ha^{-1} (PoE) at 20 DAS]. Whereas treatment T_1 (Weedy check) noted the lowest phosphorus uptake by grains (1.04 kg h^{-1}), straw (0.69 kg h^{-1}) and total uptake of phosphorus (1.73 kg ha^{-1}) by green gram crop during the field experiment.

Fig-2 Effect of weed management practices on phosphorous content (%) and their uptake

(kg ha^{-1}) by green gram crop

3.3 Potassium (K) content (%) and uptake (kg ha^{-1})

The perusal of data on potassium content in grains and straw and their uptake by grains and straw as well as their total uptake by green gram crop are presented in Table-3 and shown in Fig.-3. The study of the data revealed that there is non-significant difference in the content of potassium in grains and straw of green gram due to different treatments of weed management practices. However, the treatment T_2 (Weed free) recorded the highest potassium content in grain (1.23 %) and straw (2.36 %) of green gram, while, treatment T_1 (Weedy check) observed the lowest potassium content in grains (1.09 %) and (2.19 %) in straw of green gram crop.

Further analysis of data showed that there is significant effect of different weed management practices on uptake of the potassium by green gram crop. The application of treatment T_2 (Weed free) recorded the maximum potassium uptake by grains (15.60 kg ha^{-1}), straw (29.94 kg ha^{-1}), as well as total uptake of potassium (45.55 kg ha^{-1}) by green gram crop, which was statistically on par with treatments T_3 (Hand weeding at 20 & 35 DAS) and T_{10} [Pendimethalin @ 1.00 kg a.i. ha^{-1} (PE) + Imazethapyr @ 75.00 g a.i. ha^{-1} (PoE) at 20 DAS]. Whereas, treatment T_1 (Weedy check) noted the lowest potassium content in

S.N.	Treatments	Potassium content (%)		Potassium uptake (kg ha^{-1})		
		Grain	Straw	Grain	Straw	Total
T_1	Weedy check	1.09	2.19	4.72	9.50	14.22
T_2	Weed free	1.23	2.36	15.60	29.94	45.55
T_3	Hand weeding at 20 & 35 DAS	1.21	2.35	13.87	27.01	40.88
T_4	Quizalofop-p-ethyl @ 35.50 g a.i. ha^{-1} (PoE) at 20 DAS	1.11	2.22	7.83	15.66	23.49
T_5	Quizalofop-p-ethyl @ 75.00 g a.i. ha^{-1} (PoE) at 20 DAS	1.12	2.25	8.73	17.57	26.30
T_6	Pendimethalin @ 1.00 kg a.i. ha^{-1} (PE)	1.17	2.30	11.22	22.06	33.28
T_7	Pendimethalin @ 1.50 kg a.i. ha^{-1} (PE)	1.18	2.31	12.17	23.86	36.03
T_8	Imazethapyr @ 25.00 g a.i. ha^{-1} (PoE) at 20 DAS	1.15	2.27	9.77	19.38	29.15
T_9	Imazethapyr @ 40.00 g a.i. ha^{-1} (PoE) at 20 DAS	1.15	2.28	10.20	20.18	30.38

T_{10}	Pendimethalin @ 1.00 kg a.i ha^{-1} (PE) + Imazethapyr @ 75.00 g a.i ha^{-1} (PoE) at 20 DAS	1.20	2.33	13.17	25.57	38.74
	SEm±	***0.04***	***0.07***	***0.95***	***1.57***	***2.55***
	C.D at 5%	***NS***	***NS***	***2.84***	***4.71***	***7.64***

Table-3 Effect of weed management practices on phosphorous content (%) and their uptake (kg ha^{-1}) by green gram crop

Fig.-3 Effect of weed management practices on phosphorous content (%) and their uptake (kg ha^{-1}) by green gram crop

grains (4.72 kg h^{-1}), straw (9.50 kg h^{-1}) and total uptake of potassium (14.22 kg ha^{-1}) by green gram crop during the field experiment.

4. DISCUSSION

The application of different weed management practices enhanced the nutrient content and uptake of nitrogen, phosphorus and potassium by grains and straw of the green gram crop during the field experiment. The increase in nitrogen content and uptake by green gram crop over the control treatment might due to beneficial effect of weed management practices, which enhanced the nutrient release and promote the growth and the yield. The removal of weeds at regular interval by hand weeding and using of several herbicides, such as Pendimethalin, Imazethapyr and Quizalofop-p-ethyl accounted for less count of weed population in treatment weed free. In general, pre-emergence application of herbicide was better than the post- emergence application for controlling weed count. It may be due to less competition of plant and weed for nutrients, but in treatment weedy check the rate of nutrients content and uptake of nitrogen by plants was very slow. This is due to weed suppress the vegetative growth of plants by competition to light, nutrients and moisture. The results are in close agreement with the findings of **Balyan and Kumpawat (2008) [18], Raman and Krishnamoorthy (2005) [19]** and **Jat et al (2012) [20].** The content and uptake of phosphorus might be increased due to the application of weed management practices enhanced the efficiency of phosphorus absorbing mechanisms and encourages the root growth which enhanced the phosphorus uptake, while, the weed free treatment recorded maximum phosphorous content and their uptake of green gram crop and this treatment was closely followed by some herbicides like Pendimethalin and Imazethapyr (post-

emergence), Pendimethalin (pre-emergence) and Quizalofop-p-ethyl (post-emergence) on various stages of green gram crop. This might due to the combination of herbicide with hand weeding has showed the longer effect on controlling weed populations resulting in low crop-weed competition of plant and weed for nutrients, but the direct effect of phosphorous nutrition and indirect effect of phosphorous on nodulation and nitrogen fixation thereby more N and P uptake by crop. **Halvankar et al. (2005) [21], Khanet al. (2011) [22]** and **Ghanshyam** and **jat (2010) [23]** also found the similar findings of phosphorus uptake with their separate experiments. The application of different weed management treatments increased the potassium content and uptake. the treatment weed free recorded highest weed control over all the treatments. Among chemical weed control methods application of Pendimethalin and Imazethapyr recorded highest weed control which was closely followed by Pendimethalin (pre-emergence). Applying of these treatments in green gram crop noted the maximum potassium content and uptake by the crop, which has been showed to have a longer-lasting effect on weed population control. This reduces crop-weed competition for light, space and nutrients and raise high grain yield and dry matter accumulation and greater availability of potassium which ultimately resulted in increase in potassium content and uptake. Similar results were reported by **Verma et al. (2017) [24], Upperi et al. (2011) [25]** and **Marimuthu et al (2003) [26]** from their experiments.

5. Conclusion: In conclusion, application of different weed management practice failed to show significant effects on the nutrient content *i.e*. nitrogen, phosphorous and potassium in grains and straw of green gram crop. However, the maximum nitrogen, phosphorous and potassium content in grains and straw of green gram crop, were recorded under treatment T_2 (Weed free) and minimum under treatment T_1 (Weedy check). Whereas, the various weed management practices significantly affected the uptake of nitrogen, phosphorous and potassium by green gram crop during the field study. The highest uptake of nitrogen, phosphorous and potassium by grains, straw as well as total uptake by green gram crop was found under the treatment T_2 (Weed free) which was comparable with treatments T_3 (Hand weeding 20 & 35 DAS) and T_{10} [Pendimethalin @ 1.00 kg a.i. ha^{-1} (PE) + Imazethapyr @ 75.00 g a.i. ha^{-1} (POE) at 20DAS]. The minimum uptake of N, P and K was observed under treatment T_1 (Weedy check).

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