Original Research Article

IMPACT OF CHEMICAL WEED MANAGEMENT PRACTICES ON YIELD, NUTRIENT UPTAKE AND BALANCE IN SOIL OF HIGH DENSITY PLANTING COTTON IN DEEP VERTISOLS

ABSTRACT

In order to assess Clomazone 50 EC's effectiveness on seed cotton yield, nutrient uptake, and balance in HDPS cotton in deep Vertisols of the Northern Karnataka region, a field experiment was carried out in 2017–18 and 2018–19. The recommended course of treatment includes pre-emergence applications of Clomazone 50 EC at 250, 500, and 750 g a.i./ha compared to pendimethalin 37.5 CS@680 g a.i./ha, post-emergence applications of pyrithiobac sodium 10 EC and quizalofop ethyl hand weeding at 25 DAS and intercultivation at 50 and 75 days after sowing, as well as weed free. The experiment was set up using a randomised block design with triple replication. The application of Clomazone 50 EC @ 250 g a.i./ha was found to be effective in weed control and enhanced seed cotton yield (38.5%), according to the results. It led to excellent weed control, decreased nitrogen uptake by weeds, and increased nutrient uptake by the crop. Additionally, it leads to the least amount of nutrient losses in terms of uptake and losses. In order to effectively manage weeds in cotton, it was observed that Clomazone 50 EC @ 250 g a.i/ha, followed by pyrithiobac sodium 10 EC @ 75 g a.i./ha + Quizalofop ethyl 5 EC @ 75 g a.i./ha at 25 DAS, were the best applications.

Keywords: Cotton, Herbicide, Nutrient balance, Nutrient uptake by weeds

1. INTRODUCTION

Karnataka's cotton production (18.0 lakh bales) and area (5.46 lakh ha) rank eighth and seventh, respectively, with an average yield of 560 kg lint per hectare (Anon., 2018). The findings showed that, among the agronomic adjustments that could affect cotton output, weed management is seen as essential for reaching higher productivity (Manalil et al., 2017). During the early stages of crop growth, weeds compete more for nutrients, moisture, and sunlight than at later stages. Weeds can be particularly harmful to cotton production systems because they consume nitrogen 5–6 times, phosphorus 5–12 times, and potassium 2–5 times more than cotton crops during the early stages of crop growth (Mahar et al., 2007). Up to 15 to 60 days were the important period for weed competition in cotton (Sharma, 2008).

Therefore, if correct weed management techniques are used, there will be more critical nutrients and moisture available for the crop's better growth. By using the right herbicide, weeds in cotton fields can be efficiently inhibited from growing as early as the germination stage. They are better at helping the crop have a more favourable early-stage weed-free environment. Cotton weed invasion has reportedly caused yields to drop by 50–85 percent and offered intense competition (Venugopalan et al., 2009). There would therefore be more nutrients and moisture available for the crop if adequate weed management practises were followed (Jalis and Shah, 1982). Better cotton results would come from planting cotton with little weed competition during the first three to five weeks. To manage weeds during the early stages of crop development, novel pre-emergence molecules are therefore required. With a high density of cotton planted in deep vertisols, this study sought to assess the effects of chemical weed management strategies on production, nutrient uptake, and soil balance.

2. MATERIAL AND METHODS

The experiment was carried out in the Department of Agronomy, College of Agriculture, University of Agricultural Sciences, Raichur during the Kharif seasons of 2017–18 and 2018–19. Three replications of the experiment were used in its randomised completely block design. The experimental site's soil had a medium black colour and a clay loam texture. Each replication's treatments were assigned at random. The weed management techniques assessed in this study included hand weeding at 25 DAS, intercultivation at 50 and 75 DAS, and unweeded control. Chemical weed control involved applying pre-emergence herbicides on the day of sowing and post-emergence herbicides 20 days later.

The weed control methods include applying pendimethalin 38.7 CS @ 680 g a.i. /ha as PE, followed by (fb) HW at 25 DAS and IC at 50 and 75 DAS, clomazone 50 EC @ 250, 500, and 750 g a.i. /ha as PE, followed by pyrithiobac sodium 10 EC @ 75 g a.i. /ha at 25 DAS as POE, and Pendimethalin 38.7 CS @ 680 g a.i. /ha as PE fb, pyrithiobac sodium 10 EC @ 75 g a.i. /ha + quizolofop ethyl 5 EC @ 37.5 g a.i. /ha at 25 DAS as POE, Clomazone 50 EC @ 250, 500, and 750 g a.i. /ha as PE fb pyrithiobac sodium 10 EC @ 75 g a.i. /ha + quizolofop ethyl 5 EC @ 37.5 g a.i. /ha at 25 DAS as POE, pendimethalin 38.7 CS @ 680 g a.i. /ha as PE fb pyrithiobac sodium 10 EC @ 75 g a.i. /ha + quizolofop ethyl 5 EC @ 37.5 g a.i. /ha at 25 DAS as POE, One HW at 25 DAS and IC at 50 and 75 days after sowing, weed free check and unweeded control. Cotton variety Suraj was chosen for the investigation in both of the seasons. Using a high density planting method, seeds were sown with a 90 cm x 30 cm spacing. Clomazone 50 EC was applied at 250, 500, and 750 g a.i. /ha as PE, Pendimethalin 38.7 CS was applied at 680 g a.i. /ha as PE, and pyrithiobac sodium 10% EC was applied at 62.5 g /ha and quizalofop-p-ethyl 5% EC was applied at 25 DAS as post-emergence. The samples of weeds utilised for nutritional analysis were gathered to estimate dry matter production at maturity. The crop samples were ground using a Willey mill device to determine the intake of important nutrients such as N, P, and K.

2.1 Nutrient uptake (kg /ha)

After digesting the samples with H2SO4 and H2O2, the primary nutrient nitrogen content (%) in the plant and weed samples was calculated using the micro Kjeldahl method using the Kelplus N analyser (Piper,1966). The tri-acid (HNO3, HCLO4, and H2SO4) in the ratio of (9:3:1) was evaluated by Vanado-molybdo phosphoric acid to estimate the phosphorus content of digested plant and weed samples. At 420 nm, the intensity of the produced yellow colour was determined using a spectrophotometer (Piper, 1966). A flame photometer equipment was used to measure the tri-potassium acid's level (Piper, 1966).

Nutrient uptake = Nitrogen / phosphorus / potassium of plant parts / weeds x weight of seed cotton yield (kg /ha) / weeds weight

2.2 Data analysis

To ascertain the impact of time and rate of application of herbicides on weed type, lit yield, and nutrient uptake by weeds and crop, analysis of variance (ANOVA) for the randomised complete block design was done. For all analyses, SAS 9.3 (SAS Institute, Cary, NC, USA 2008) was used. If the ANOVA for the multi-year combined data indicated a significant effect between treatments and years, a separate ANOVA was run for each individual year.

3. RESULTS AND DISCUSSION

3.1 Weed Flora at experimental site

The type of weed that was seen in *vertisols* was noted. *Cynodon dactylon, Rottboellia exaltata, Dactyloctenium aegyptium, and Dinebraretro flexa* were among the grasses that were identified. The only sedge that was present in the field was *Cyperus rotundus. Phyllanthus niruri, Commelina benghalensis, Euphorbia geniculata, Trianthema portulaca strum, Trichodesma indica, Parthenium hysterophorus, Digera arvensis, and Tridax procumbens* were among the broad-leaved weeds that were spotted in the field. The yield is impacted by weeds' competition with crops for moisture, nutrients, light, and CO_2. In order to ascertain the impact of the management measures, it is crucial to determine the crop's nutrient uptake.

3.2 NPK uptake by weeds

Results on nutrient uptake by weeds showed that weed-free control over unweeded control (42.4, 5.95, 43.3 kg NPK /ha) was much lower than other treatments. Pendimethalin 38.7 CS @ 680 g a.i. /ha (9.0 kg /ha) and clomazone 50 EC @ 250 g a.i. /ha (7.8 kg /ha) applied during pre-emergence, or pyrithiobac sodium 10 EC @ 75 g a.i. /ha applied during post-emergence, or both combined with quizolofop ethyl 5 EC @ 37.5 g a It remained the same for both years. It may be because unweeded control has higher weed intensity and biomass, and because weeds exploit natural resources like sunlight, moisture, and CO2 and applied inputs more efficiently than plants, leading to the accumulation of more dry matter in weeds. Less weed dry matter in the corresponding treatments led to increased nitrogen absorption from the soil and decreased nutrient uptake by weeds. These outcomes were very similar to those of Hiremath et al. (2013) and Shivashankar (2016). Unweeded control has dramatically reduced N uptake throughout the entire crop growth cycle (Table 1).

3.3 NPK uptake by cotton

Average data collected over two years revealed that weed free check greatly outperformed the other treatments in terms of nitrogen, phosphorus, and potassium uptake (97.2, 13.1 and 95.0 kg NPK /ha, respectively) (Table 2). It was lowest in weed-free areas (65.5, 8.10 and 64.7 kg /haNPK, respectively). In comparison to unweeded control, all weed management techniques enhanced the NPK concentration in plants and their absorption. Furthermore, with the exception of unweeded control and integrated weed control treatments, weed free check was beneficial in improving nutrient uptake. Pre-emergence applications of Clomazone 50 EC @ 250 g a.i./ha as PE fb pyrithiobac sodium 10 EC @ 75 g a.i.//ha + quizolofop ethyl 5 EC @ 37.5 g a.i.//ha at 25 DAS as PoE recorded higher N uptake (85.8 kg /ha), and clomazone 50 EC @ 750 g a.i (85.5 kg/ha). The crop's ability to absorb nutrients depended on the amount of dry matter it produced, the availability of nutrients, and the concentration of nutrients in the plants. This is because there was less weed competition in plots during the crop phase, which allowed the crop to produce more dry matter and absorb more nutrients (Nalayini et al., 2001).

3.4 Seed cotton yield

It showed that the application of Clomazone @ 250 g a.i. /ha was determined to be the most effective when the PE concentration was increased to 500 g a.i. /ha or 750 g a.i. /ha (Table 3). These treatments considerably outperformed unweeded control (862 kg /ha) and HW at 25 DAS as well as IC at 50 and 75 DAS, and were on par with weed-free check (1517 kg /ha) overall (1148 kg /ha). These treatments had yield increases of 43.2%, 35.9%, and

35.8% in comparison to the unweeded control. Positive correlations between yield and nutrient uptake by weeds and cotton crops may account for the variation in seed cotton yield. These treatments may result in better cotton plant development since there is less competition for nutrients from weeds. In contrast to weedy plots, hand weeding and herbicidal treatments reduced the weed infestation, according to Shahzad et al(2012) .'s research. The main reason for this was the severe weed infestation and poor yield components, such as fewer boll plants per plant, fewer sympodial branches, and a poorer seed index under unweeded control.

3.5 Soil nitrogen balance

Different weed management techniques during both years resulted in significant differences in the soil nitrogen balance (Table 4). The amount of nitrogen added to the soil by inorganic fertiliser and the soil's N status at harvest were taken into account while calculating the nutrient balance sheet. The data showed that higher total N was recorded in clomazone 50 EC @ 250 g *a.i.*/ha as PE *fb* HW at 25 DAS and IC at 50 and 75 DAS (256 kg/ha) followed by clomazone 50 EC @ 500 g *a.i/* ha as PE followed by pyrithiobac sodium 10EC 75 g *a.i.*/ha at 25 DAS as POE (253 kg/ha), clomazone 50 EC @ 500 g *a.i.* /ha as PE *fb* pyrithiobac sodium 10 EC @ 75 g *a.i/* ha + application of quizolofop ethyl 5 EC @ 37.5 g *a.i/*ha at 25 DAS as POE (252.4 kg/ha) and weed free check (252 kg/ha). Unweeded control showed lower total nitrogen levels (224 kg /ha). Clomazone 50 EC @ 750 g a.i. /ha as PE fb HW at 25 DAS and IC at 50 and 75 DAS (162.3 kg /ha) had the highest N balance, followed by clomazone 50 EC @ 250 g a.i. /ha as PE fb pyrithiobac sodium 10EC 75 g a.i. /ha at 25 DAS as POE (161.2 kg /ha), clomazone 50 (158 kg /ha). The unweeded control has the lowest N balance (108.5 kg /ha). Various treatments resulted in different net gains or losses. Clomazone 50 EC @ 750 g a.i. /ha was applied as PE fb HW at 25 DAS and IC at 50 and 75 DAS. This method produced the highest net gain (13.2 kg /ha) and was followed by pendimethalin 38.7 CS @ 680 g a.i. /ha as PE fb HW at 25 DAS and IC at 50 and 75 DAS (6.12 kg /ha) and weed free check (3 (2.62 kg /ha). Greater negative values in the other treatments' records suggest more losses through different channels[12].

3.6 Soil phosphorus balance

During the 2017–18 and 2018–19 growing seasons, a variety of weed management techniques significantly altered the soil phosphorus balance (Table 4). Balance sheet following the second crop's harvest, showing the amount of chemical fertiliser used and the soil P status at harvest. One HW at 25 DAS and IC at 50 and 75 DAS (116.5 kg /ha), Clomazone 50 EC @ 750 g a.i. /ha as PE fb HW at 25 DAS and IC at 50 and 75 DAS (115.7

kg /ha), and Clomazone 50 EC @ 500 g a.i. /ha as PE fb pyrithiobac sodium 10 EC 75 g a.i. /ha at 25 (114.2 kg /ha). Unweeded control plants received the least phosphorus (82.20 kg /ha).

The soil state at the end of the second year cycle predicted a P balance that was highest in weed free check (96 kg /ha) and lowest in HW at 25 DAS and IC at 50 and 75 DAS (90.50 kg /ha) and highest in Clomazone 50 EC @ 750 g a.i. /ha as PE fb HW at 25 DAS and IC at 50 and 75 DAS (88.97 kg /ha). The unweeded control has the lowest P. (76.50 kg /ha). Various treatments resulted in different net gains or losses. The unweeded control had a net gain in soil phosphorus (7.46), followed by the weed-free control, which had a net loss (-9.12 kg /ha), whereas the other treatments had negative values.

3.7 Soil potassium balance

In both years, different weed management techniques resulted in significant differences in the soil K. (Table 4). The statistics showed that at the conclusion of the experiment, there was a net gain of K in all of the weed management strategies, regardless of those practises. The findings showed that unweeded control had a higher net increase (9.5 kg /ha), however weed free check had a higher gain (64.5 kg /ha) when compared to unweeded control and other treatments. In 2018–19, nutrient balance was calculated based on the condition of the soil during harvest and the volume of fertiliser used. The weed-free check had the highest potassium content (562.0 kg /ha), followed by clomazone 50 EC @ 750 g a.i. /ha as PE fb HW at 25 DAS and IC at 50 and 75 DAS (548.5 kg /ha), and clomazone 50 EC @ 500 g a.i. /ha as pre-emergence, which was followed by pyrithiobac sodium 10 EC 75 g a.i. ha (468.2 kg /ha). The two-year balance sheet showed a positive balance of K in the soil, both predicted and estimated. With various treatments, there was a varying net gain or loss. The weed-free (53.5 kg /ha) and Clomazone 50 EC @ 750 g a.i. /ha as PE fb pyrithiobac sodium 10 EC @ 75 g a.i. /ha + quizolofop ethyl 5 EC @ 37.5 g a.i. /ha at 25 DAS as PoE (38.6 kg /ha) treatments had the highest net K increase, followed by the unweeded control. Both Clomazone 50 EC @ 750 g a.i. /ha as PE fb pyrithiobac sodium 10EC 75 g a.i. /ha at 25 DAS as PoE and Clomazone 50 EC @ 250 g a.i /ha as PE fb HW at 25 DAS and IC at 50 and 75 DAS (6.3 kg /ha) showed the lowest potassium gain (9.1 kg /ha).

Pre-emergence application of clomazone 50 EC @ 250 g a.i. /ha followed by pyrithiobac sodium 10 EC @ 75 g a.i. /ha + quizolofop ethyl 5 EC @ 37.5 g a.i. /ha at 25 DAS as PoE resulted in significantly higher soil available NPK estimates due to lower weed population and weed dry weight, which resulted in lower nutrient uptake. After the crop was harvested, it might have led to extra nutrients being available in the soil. Due to weeds not being controlled, as shown by a larger weed population and weed dry weight, the unweeded check recorded reduced soil available NPK. Weeds use nutrients more aggressively than agricultural plants, which is a well-known fact. Madavi (2016) made similar observations as well.

4. CONCLUSION

The study's findings demonstrated that the levels of macronutrients in cotton crops were higher in weed-free controls and comparable to pre-emergence applications of clomazone 50 EC @ 250 g a.i. /ha as PE, followed by pyrithiobac sodium 10 EC @ 75 g a.i. /ha + quizolofop ethyl 5 EC @ 37.5 g a.i. /ha at 25 DAS as post-emergence. In pre-emergence applications of pendimethalin 38.7 CS @ 680 g a.i. /ha, pre-emergence applications of clomazone 50 EC @ 250 g a.i. /ha with HW at 25 DAS and IC at 50 and 75 DAS, or post-emergence applications of Pyrithiobac sodium 10 EC @ 75 g a.i./ha, the amount of nutrients removed by weeds was also minimal over unweeded control. The use of Clomazone 50EC fb HW at 25 DAS and IC at 50, 75 DAS as an environmentally friendly weed management strategy in cotton resulted in increased losses in the nutrient balance following crop harvest.

Competing Interest: We declared that there was no competing interest exists.

5. REFERENCES

1. Anonymous, ICAR-Central Institute for Cotton Research state wise cotton area, production and productivity. 2018; *www.cicr.org.in/database/dbcapp5.html.*

2. Hiremath R, Yadahalli GS, Chittapur BM, Siddapur AD, Yadahalli VG, Koppalkar BG, Efficacy of chemical weed management in Bt cotton (*Gossypium hirsutum* L.). Acta Biologica Indica, 2013; 2(2):425-429.

3. Jalis A, Shah ML. Weed control in cotton resume. The Pakistan Cottons. 1982; 26 (3):141-48.

4. Mahar GM, Oad FC, Buriro UA, Solangi GS. Effect of post-emergence herbicide on the yield of up- land cotton. Asian Journal of Plant Sciences. 2007; 6(8):1282-86.

5. Manalil S, Coast O, Werth J, Chauhana BS. Weed management in cotton (*Gossypium hirsutum* L.) through weed-crop competition: A review. Crop Protection. 2017; 95:53-59.

6. Mohamed Ali A. Bhanumurthy VB. *Trianthema portulacastrum* L. competition and control in *Gossypium hirsutum* L. under irrigated conditions. Tropical Pest Management. 1985; 31(3): 232–234.

7. Piper, C. S., 1966.Soil and Plant Analysis. Hans Publisher, Bombay.

8. Shahzad, M. A., Nadeem, M. A., Sarwar, G. M., Naseeruddin and Allah, F., 2012. Comparative efficacy of different post-emergence herbicides in wheat (*Triticum aestivum* L.). Pakistan J. Agri. Sci., 49: 27-34.

9. Sharma R. Integrated weed management in field crops. Crop Care. 2008; 35:41-46.

10. Shivashankar, Channabasavanna AS, Ananda N, Krishnamurthy D, Mahadevswamy. Studies on weed management practices in irrigated *Bt*-Cotton. J. Farm Sci., 2017; 30 (2): 283-284.

11. Venugopalan MV, Sankaranarayanan K, Blaise D, Nalayini P, Prahraj CS, Gangaiah B. Bt cotton (*Gossypium sp*.) in India and its agronomic requirements A review. Indian J. Agronomy. 2009; 54 (4): 343-360.

12. Kamble Anand Shankar*, A. S. Channabasavanna, M. Y. Ajayakumar, Koppalkar, B. G. Mahadevswamy and A. Amaregouda Eco-friendly Weed Management Strategies

for High Density Planting System Cotton in Vertisol of Northern Karnataka Int.J.Curr.Microbiol.App.Sci(2020)9(11):1021-1029

Table 1. Nitrogen, Phosphorus and potassium uptake by weeds as influenced by different chemical weed management practices in HDPS cotton

	Treatment	N uptake (kg /ha)			P uptake (kg /ha)			K uptake (kg /ha)		
		2017	2018	Pooled	2017	2018	Pooled	2017	2018	Pooled
T1	Pendimethalin 38.7 CS @ 680 g *a.i*/ha as PE *fb* HW at 25 DAS and IC at 50 and 75 DAS	9.09	8.90	9.0	1.29	1.26	1.28	9.55	9.37	9.46
T2	Clomazone 50 EC @ 250 g *a.i* /ha as PE *fb* HW at 25 DAS and IC at 50 and 75 DAS	7.76	7.76	7.8	1.02	1.02	1.02	7.57	7.57	7.57
T3	Clomazone 50 EC @ 500 g *a.i.* /ha as PE *fb* HW at 25 DAS and IC at 50 and 75 DAS	7.64	7.64	7.6	1.05	1.05	1.05	7.78	7.78	7.78
T4	Clomazone 50 EC @ 750 g *a.i.* /ha as PE *fb* HW at 25 DAS and IC at 50 and 75 DAS	9.19	8.39	8.8	1.32	1.19	1.26	8.76	8.00	8.38
T5	Clomazone 50 EC @ 250 g *a.i.* /ha as PE *fb* pyrithiobac sodium 10EC 75 g *a.i.* /ha at 25 DAS as PoE	9.46	7.14	8.3	1.34	1.00	1.17	9.39	7.10	8.25
T6	Clomazone 50 EC @ 500 g *a.i.* /ha as PE *fb*pyrithiobac sodium 10EC 75 g *a.i.* /ha at 25 DAS as PoE	7.72	7.91	7.8	1.12	1.14	1.13	8.55	8.72	8.64
T7	Clomazone 50 EC @ 750 g *a.i.* /ha as PE *fb*pyrithiobac sodium 10EC 75 g *a.i.* /ha at 25 DAS as PoE	8.68	7.01	7.8	1.25	1.00	1.12	8.91	7.16	8.04
T8	Clomazone 50 EC @ 250 g *a.i.*/ha as PE *fb*pyrithiobac sodium 10 EC @ 75 g *a.i.* /ha + quizolofop ethyl 5 EC @ 37.5 g *a.i.*/ha at 25 DAS as PoE.	10.8	8.17	9.5	1.65	1.24	1.44	11.1	8.39	9.75
T9	Clomazone 50 EC @ 500 g *a.i.*/ha as PE *fb*pyrithiobac sodium 10 EC @ 75 g *a.i.*/ha + quizolofop ethyl 5 EC @ 37.5 g *a.i.* /ha at 25 DAS as PoE.	11.5	10.5	11.0	1.61	1.46	1.54	10.6	9.69	10.2
T10	Clomazone 50 EC @ 750 g *a.i.* /ha as PE *fb* pyrithiobac sodium 10 EC @ 75 g *a.i.* /ha + quizolofop ethyl 5EC @ 37.5 g *a.i.* /ha at 25 DAS as PoE.	10.7	6.88	8.8	1.63	1.02	1.32	11.2	7.22	9.23
T11	Pendimethalin 38.7 CS @ 680 g *a.i.* /ha as PE *fb* pyrithiobac sodium 10 EC @ 75 g *a.i.* /ha + quizolofop ethyl 5 EC @ 37.5 g *a.i.* /ha at 25DAS as PoE	12.3	8.22	10.3	1.80	1.20	1.50	12.5	8.37	10.4
T12	HW at 25 DAS and IC at 50 and 75 DAS	9.67	7.07	8.4	1.42	1.04	1.23	9.37	6.84	8.10
T13	Weed free check	-	-	-	-	-	-	-	-	-
T14	Unweeded control	47.9	37.0	42.4	6.77	5.14	5.95	48.9	37.7	43.3
	S.Em±	1.50	1.30	1.00	0.37	0.16	0.24	1.54	1.04	0.92
	C.D. at 5%	4.30	3.60	3.00	1.07	0.47	0.70	4.46	3.03	2.69

Table 2.Nitrogen, phosphorus and potassium uptake by high density planting cotton as influenced by different chemical weed management practices

	Treatment	N uptake(kg /ha)			P uptake(kg /ha)			K uptake(kg /ha)		
		2017	2018	Pooled	2017	2018	Pooled	2017	2018	Pooled
T1	Pendimethalin 38.7 CS @ 680 g *a.i*/ha as PE *fb* HW at 25 DAS and IC at 50,75DAS	84.6	78.7	81.6	11.6	11.1	11.4	82.5	82.5	82.5
T2	Clomazone 50 EC @ 250 g *a.i* /ha as PE *fb* HW at 25 DAS and IC at 50, 75 DAS	73.1	65.8	69.5	9.4	8.9	9.2	64.4	65.4	64.9
T3	Clomazone 50 EC @ 500 g *a.i.* /ha as PE *fb* HW at 25 DAS and IC at 50,75 DAS	74.8	77.5	76.1	9.9	10.1	10.0	70.5	85.4	77.9
T4	Clomazone 50 EC @ 750 g *a.i.* /ha as PE *fb* HW at 25 DAS and IC at 50, 75 DAS	74.1	78.6	76.3	10.1	10.5	10.3	65.8	76.6	71.2
T5	Clomazone 50 EC @ 250 g *a.i.* /ha as PE *fb* pyrithiobac sodium 10EC 75 g *a.i.* /ha at 25 DAS as PoE	71.4	62.5	66.9	9.2	8.5	8.9	62.4	59.3	60.8
T6	Clomazone 50 EC @ 500 g *a.i.* /ha as PE *fb* pyrithiobac sodium 10EC 75 g *a.i.* /ha at 25 DAS as PoE	77.6	67.8	72.7	10.1	9.5	9.8	71.8	71.2	71.5
T7	Clomazone 50 EC @ 750 g *a.i.* /ha as PE *fb* pyrithiobac sodium 10EC 75 g *a.i.* /ha at 25 DAS as PoE	76.6	75.2	75.9	10.0	9.9	10.0	68.8	81.2	75.0
T8	Clomazone 50 EC @ 250 g *a.i.*/ha as PE *fb* pyrithiobac sodium 10 EC @ 75 g *a.i.* /ha + quizolofop ethyl 5 EC @ 37.5 g *a.i.*/ha at 25 DAS as PoE.	88.3	83.3	85.8	10.8	10.5	10.7	76.4	83.3	79.8
T9	Clomazone 50 EC @ 500 g *a.i.*/ha as PE *fb* pyrithiobac sodium 10 EC @ 75 g *a.i.*/ha + quizolofop ethyl 5 EC @ 37.5 g *a.i.* /ha at 25 DAS as PoE.	81.8	82.0	81.9	10.7	10.7	10.7	71.1	74.1	72.6
T10	Clomazone 50 EC @ 750 g *a.i.* /ha as PE *fb* pyrithiobac sodium 10 EC @ 75 g *a.i.* /ha + quizolofop ethyl 5EC @ 37.5 g *a.i.* /ha at 25 DAS as PoE.	80.0	70.2	75.1	11.7	10.9	11.3	89.1	81.9	85.5
T11	Pendimethalin 38.7 CS @ 680 g *a.i.* /ha as PE *fb* pyrithiobac sodium 10 EC @ 75 g *a.i.* /ha + quizolofop ethyl 5 EC @ 37.5 g *a.i.* /ha at 25DAS as PoE	91.6	77.8	84.7	11.1	10.3	10.7	86.4	77.8	82.1
T12	HW at 25 DAS and IC at 50,75 DAS	80.0	77.3	78.6	10.2	10.1	10.2	78.7	80.7	79.7
T13	Weed free check	96.6	97.7	97.2	13.0	13.1	13.1	92.3	97.7	95.0
T14	Unweeded control	65.6	65.3	65.5	8.1	8.0	8.1	64.0	65.3	64.7
	S.Em±	2.8	5.4	3.0	0.6	0.8	0.6	2.9	5.0	0.9
	C.D. at 5%	8.1	15.8	8.7	1.8	2.3	1.7	8.5	14.6	2.7

Table 3: Balance sheet of available NPK in soil after second year of high density planting cotton as influenced by different chemical weed management practices

	Treatment	Nitrogen (kg /ha)			Phosphorus (kg /ha)			Potassium (kg /ha)		
		Soil supply and applied	Total uptake	Net gain/ loss	Soil supply and applied	Total uptake	Net gain/ loss	Soil supply and applied	Total uptake	Net gain/ loss
T1	Pendimethalin 38.7 CS @ 680 g *a.i*/ha as PE *fb* HW at 25 DAS and IC at 50 and 75 DAS	228.0	87.6	6.1	112.6	12.0	-18.0	592.0	86.2	28.7
T2	Clomazone 50 EC @ 250 g *a.i* /ha as PE *fb* HW at 25 DAS and IC at 50, 75 DAS	256.0	73.5	-30.5	109.0	9.5	-22.5	581.2	66.1	6.3
T3	Clomazone 50 EC @ 500 g *a.i.* /ha as PE *fb* HW at 25 DAS and IC at 50,75 DAS	242.5	85.1	2.6	110.3	11.3	-20.7	592.2	81.0	25.5
T4	Clomazone 50 EC @ 750 g *a.i.* /ha as PE *fb* HW at 25 DAS and IC at 50 and 75 DAS	236.0	87.0	13.3	115.7	12.0	-14.7	602.8	77.8	23.5
T5	Clomazone 50 EC @ 250 g *a.i.* /ha as PE *fb* pyrithiobac sodium 10EC 75 g *a.i.* /ha at 25 DAS PoE	238.5	69.6	-7.7	112.2	8.8	-15.8	582.5	61.0	21.1
T6	Clomazone 50 EC @ 500 g *a.i.* /ha as PE *fb* pyrithiobac sodium 10EC 75 g *a.i.* /ha at 25 DAS PoE	253.0	75.7	-28.3	114.2	9.9	-17.8	592.8	71.7	23.7
T7	Clomazone 50 EC @ 750 g *a.i.* /ha as PE *fb* pyrithiobac sodium 10EC 75 g *a.i.* /ha at 25 DAS as PoE	249.5	82.2	-12.3	113.6	10.8	-17.3	600.1	75.0	9.1
T8	Clomazone 50 EC @ 250 g *a.i.*/ha as PE *fb* pyrithiobac sodium 10 EC @ 75 g *a.i.* /ha + quizolofop ethyl 5 EC @ 37.5 g *a.i.*/ha at 25 DAS as PoE	250.0	91.5	-3.6	107.4	11.5	-11.5	576.4	80.3	20.2
T9	Clomazone 50 EC @ 500 g *a.i.*/ha as PE *fb* pyrithiobac sodium 10 EC @ 75 g *a.i.*/ha + quizolofop ethyl 5 EC @ 37.5 g *a.i.* /ha at 25 DAS as PoE	252.4	92.5	-8.9	112.4	12.2	-13.8	568.2	81.0	31.0
T10	Clomazone 50 EC @ 750 g *a.i.* /ha as PE *fb* pyrithiobac sodium 10 EC @ 75 g *a.i.* /ha + quizolofop ethyl 5EC @ 37.5 g *a.i.* /ha at 25 DAS as PoE	251.2	77.1	-10.8	105.5	11.2	-13.8	567.6	85.5	38.6
T11	Pendimethalin 38.7 CS @ 680 g *a.i.* /ha as PE *fb* pyrithiobac sodium 10 EC @ 75 g *a.i.* /ha + quizolofop ethyl 5 EC @ 37.5 g *a.i.* /ha at 25DAS as PoE	252.2	86.1	-20.2	106.4	10.6	-11.4	569.4	81.7	30.1
T12	HW at 25 DAS and IC at 50, 75 DAS	247.0	84.4	-19.6	116.5	10.9	-15.1	596.5	83.0	23.7
T13	Weed free check	252.0	97.7	3.7	118.3	13.2	-9.1	602.0	93.5	53.5
T14	Unweeded control	223.5	102.3	-12.7	82.2	13.2	7.5	426.4	101.3	143.1

Table 4: Seed cotton yield as influenced by chemical weed management approaches in high density planting cotton

	Treatment	2017	2018	Pooled
T1	Pendimethalin 38.7 CS @ 680 g *a.i* /ha *fb* HW at 25 DAS and IC at 50 &75 DAS	1367	1326	1346
T2	Clomazone* 50 EC @ 250 g *a.i* /ha *fb* HW at 25 DAS and IC at 50 and 75 DAS	1387	1304	1345
T3	Clomazone 50 EC @ 500 g *a.i.* /ha *fb* HW at 25 DAS and IC at 50 and 75 DAS	1477	1410	1444
T4	Clomazone 50 EC @ 750 g *a.i.* /ha *fb* HW at 25 DAS and IC at 50 and 75 DAS	1370	1183	1277
T5	Clomazone 50 EC @ 250 g *a.i.* /ha *fb* Pyrithiobac sodium 10EC 75 g *a.i.* /ha at 25DAS	1407	1246	1326
T6	Clomazone 50 EC @ 500 g *a.i.* /ha *fb* Pyrithiobac sodium 10EC 75 g *a.i.* /ha at 25 DAS	1417	1267	1342
T7	Clomazone 50 EC @ 750 g *a.i.* /ha *fb* Pyrithiobac sodium 10EC 75 g *a.i.* /ha at 25 DAS	1361	1243	1302
T8	Clomazone 50 EC @ 250 g *a.i.*/ha *fb* Pyrithiobac sodium 10 EC @ 75 g *a.i.* /ha + Quizolofop ethyl 5 EC @ 37.5 g *a.i.* /ha at 25 DAS ¥	1296	1219	1258
T9	Clomazone 50 EC @ 500 g *a.i.* /ha *fb* Pyrithiobac sodium 10 EC @ 75 g *a.i.* /ha + Quizolofop ethyl 5 EC @ 37.5 g *a.i.* /ha at 25 DAS	1407	1267	1337
T10	Clomazone 50 EC @ 750 g *a.i.* /ha *fb* Pyrithiobac sodium 10 EC @75 g *a.i.* /ha + Quizolofop ethyl 5EC @ 37.5 g *a.i.* /ha at 25 DAS	1283	1173	1228
T11	Pendimethalin 38.7 CS @ 680 g *a.i.* /ha *fb* Pyrithiobac sodium 10 EC @ 75 g *a.i.* /ha + Quizolofop ethyl 5 EC @ 37.5 g *a.i.* /ha at 25 DAS	1300	1230	1265
T12	HW at 25 DAS and IC at 50 and 75 DAS	1159	1137	1148
T13	Weed free check	1603	1431	1517
T14	Unweeded control	859	865	862
	S.Em.±	124	84	85
	CD at 5%	360	243	246

*as pre-emergence; ¥ as post emergent