www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(12): 2421-2424

www.thepharmajournal.com
Received: 20-10-2022
Accepted: 24-11-2022

PS Panchal
B.A. College of Agriculture, Anand Agricultural University, Anand, Gujarat, India

VJ Patel
B.A. College of Agriculture, Anand Agricultural University, Anand, Gujarat, India

DD Chaudhari
B.A. College of Agriculture, Anand Agricultural University, Anand, Gujarat, India

MP Dohat
B.A. College of Agriculture, Anand Agricultural University, Anand, Gujarat, India

Corresponding Author:
PS Panchal
B.A. College of Agriculture, Anand Agricultural University, Anand, Gujarat, India

Evaluation of different herbicides on growth, yield attributes and yield of *Bt.* cotton and their residual effect on succeeding summer groundnut

PS Panchal, VJ Patel, DD Chaudhari and MP Dohat

Abstract
To evaluate the effect of different herbicides on growth, yield attributes and yield of *Bt*. cotton and their residual effect on succeeding summer groundnut, a field investigation was carried out during two consecutive *kharif* and summer seasons of 2019-20 and 2020-21 at the farm of AICRP-Weed Management, B.A. College of Agriculture, Anand Agricultural University, Anand, Gujarat. Tank mix application of pendimethalin (38.7% CS) 500 g/ha + oxyfluorfen 50 g/ha as PE *fb* pyrithiobac-sodium 62.5 g/ha + quizalofop-ethyl 50 g/ha as PoE (Tank mix), oxyfluorfen 100 g/ha as PE *fb* glufosinate ammonium 375 g/ha as directed spray as PoE and IC + HW at 20, 40 and 60 DAS recorded higher plant height, monopodial and sympodial branches, number of bolls/plant, seed index and seed cotton yield by achieving lower weed count and dry weight as well as higher weed control efficiency in *Bt.* cotton. Further, no residual effect of applied herbicides was observed on succeeding summer groundnut crop at tested dose in loamy sand soils of middle Gujarat.

Keywords: Cotton, groundnut, herbicides, residual effect, seed cotton yield, weed

Introduction
Cotton has a pride place among the cultivated plants that satisfy the need of man which is necessary for the life. Cotton is one of the important commercial crops belonging to the family Malvaceae exercising profound influence on national economy and social affairs of the world. In India textile industries is totally predominantly by the cotton. There are biotic and abiotic stress limit the production of cotton but the most troublesome one is weeds because it competes with the crop particularly during early stages of crop growth. Due to this competition, several direct or indirect negative impacts *viz.*, reducing fibre quality, reducing crop yield, increasing production cost, reducing irrigation efficiency and alternate host for insect pest and disease-causing pathogen observed by the several scientists. On the other hand, scarcity of labours, high soil moisture conditions due to heavy rains during *kharif* season make the farmers unable to take up timely hand weeding besides, mechanical method of weed control became time consuming, labour and cost expensive and tedious one. Hence, it is necessary to control weeds by using herbicides to get higher yields. Further, over reliance on single mode of action of herbicide rather than a diversified integrated weed management system with multiple and complementary herbicide mode of action can lead to emergence of herbicide tolerant weeds (Ramachandra *et al.*, 2016) [1]. In long duration crops like cotton, weeds flourish even after critical period of crop weed competition and it is difficult to achieve effective weed control with single application of herbicides. Hence, in order to control weeds for a longer period of crop growth, it needs to apply herbicides on sequential basis. But herbicides are chemical in nature, therefore, excessive and repeated use may pose residue problems, phytotoxicity to crop plants, residual effects on succeeding crops and ultimately health hazards to human and animals (Sondhia, 2014) [2]. Moreover, cotton-groundnut is one of the major cropping systems of the Gujarat state. Looking to the above background, the present investigation was carried out to evaluate the effect of different herbicides on growth, yield attributes and yield of *Bt*. cotton and their residual effect on succeeding summer groundnut.

Materials and Methods
A field experiment was planned and executed during two consecutive *kharif* and summer seasons of the year 2019-20 and 2020-21 in loamy sand soil at the farm of AICRP-Weed Management, B. A. College of Agriculture, Anand Agricultural University, Anand, Gujarat.

Total ten treatment consisted of pendimethalin 750 g/ha (38.7% CS) PPI *fb* glufosinate ammonium 375 g/ha PoE directed spray, oxyfluorfen 100 g/ha PE *fb* glufosinate ammonium 375 g/ha PoE directed spray, pendimethalin 750 g/ha (30% EC) PE *fb* glyphosate 2000 g/ha PoE directed spray, pendimethalin 750 g/ha (30% EC) PE *fb* paraquat 600 g/ha PoE directed spray, pendimethalin 1000 g/ha (30% EC) PE *fb* pyrithiobac-sodium 62.5 g/ha + quizalofop-ethyl 50 g/ha PoE (Tank mix), pendimethalin (38.7% CS) 500 g/ha + oxyfluorfen 50 g/ha PE (Tank mix) *fb* pyrithiobac-sodium 62.5 g/ha + quizalofop-ethyl 50 g/ha PoE (Tank mix), pendimethalin 1000 g/ha (38.7% CS) PE *fb* IC + HW at 40 DAS, pyrithiobac-sodium 62.5 g/ha PoE + quizalofop-ethyl 50 g/ha PoE (Tank mix) *fb* IC + HW at 50 DAS, IC + HW at 20, 40 and 60 DAS and weedy check were laid down under Randomized Block Design (RBD) with four replications. *Bt.* cotton variety 'GTHH 49' was sown in *kharif* season on June 13th, 2019 and May 31st, 2020 keeping the distance of 120 x 45 cm and fertilized with recommended dose of fertilizers (240 kg N/ha in the form of urea). One fourth part of the nitrogen was applied as basal and remaining quantity of nitrogen was applied in three equal splits at 30, 60 and 90 days after sowing (DAS).

Pre-plant incorporation (PPI) of herbicides in respective treatments was given one day before first irrigation. Pre-emergence (PE) application of herbicides was sprayed two days after sowing in respective treatments while post-emergence herbicides (PoE) were applied at 30 DAS. The spraying was done by using Knapsack sprayer fitted with flat-fan nozzle using 500 L of water/ha. The data on weed density and weed dry weight was not distributed normally hence, the data were transformed by using the square root transformation $\sqrt{(X+1)}$ and then the transformed data were analysed statistically. Observations regarding weed study was taken randomly from 0.25 m^2 quadrat from net plot area from each treatment and converted into m^2 area. The mean data are used for analysis purpose. Growth and development parameters like plant height, number of monopodial and sympodial branches/plant, days to 50% flowering and visual herbicide phytotoxoxcity (0-10 scale) at 10 days after herbicide application (DAHA) were recorded. In context to yield attributes, yield and quality, various parameters like number of bolls/plant, seed cotton yield, stalk yield, ginning percentage, seed index and oil percentage were recorded. Further, to judge the residual effect of applied herbicides in *Bt.* Cotton on succeeding groundnut, the crop was sown January 21th, 2020 and January 12th, 2021 with all recommended package of practices. Different observations like dry weight of *Rhizobium* nodule/plant, residual visual phytotoxicity and pod yield of succeeding groundnut were also determined. Duncan's New Multiple Range Test (DNMRT) was employed for comparison of treatments mean and analysed at a probability level of 5%.

Results and Discussion

Effect on weeds and growth parameters of *Bt.* Cotton

Total fourteen weed species were identified in the experimental area during the crop growth period. Among all the weed species observed in the experiment *Commelina benghalensis*, *Eleusine indica*, *Digitaria sanguinalis* and *Dactyloctenium aegyptium* as monocot, *Digera arvensis*, *Trianthema monogyna*, *Phyllanthus niruri* and *Euphorbia hirta* as dicot as well as *Cyperus rotundus* as sedge were found dominant weed flora.

Results prtesented in Table 1 indicated that significantly lower weed density (3.96 no./m^2) and weed dry weight (5.88 g/m^2) at harvest as well as higher values of growth parameters like plant height (205.44 cm), number of monopodial (4.40) and sympodial branches/plant (25.35) were recorded under application of pendimethalin (38.7% CS) 500 g/ha + oxyfluorfen 50 g/ha PE (Tank mix) *fb* pyrithiobac-sodium 62.5 g/ha + quizalofop-ethyl 50 g/ha PoE (Tank mix) closely followed by treatment of oxyfluorfen 100 g/ha PE *fb* glufosinate ammonium 375 g/ha PoE as directed spray and IC + HW at 20, 40 and 60 DAS. The effectiveness of above said treatment might be due to oxyfluorfen found very effective before and at the time of weed seed germination for the control of grasses and broad leaved weeds, when applied with pendimethalin enhanced their efficacy by providing broad spectrum control of weeds might be due to prevention of rapid detoxification of active herbicide component due to mixtures application. While, second flush of weeds were managed by manually and use of post-emergence herbicides ultimately gave season long weed control weeds in critical crop weed competition period resulting higher WCE under these treatments. Results are in conformity with finding of Kamble *et al.* (2017) [3] and Madhavi and Ramprakash (2015) [4]. However, oxyfluorfen which showed slight necrosis and epinasty symptoms (10 to 20%) at initial stage on cotton which was recovered in due course of time without causing any negative effect on cotton growth.

Effect on yield attributes, yield of *Bt.* cotton and on succeeding groundnut

Weedy check recorded the lowest values of all yield parameters and seed cotton yield of 940 kg/ha which might be due to higher density of weeds under said treatment increased weed inoculum caused higher crop-weed competition right from early growth stages and ultimately resulted in most inferior yield attributes which directly lead to decrease in the uptake of nutrients by the crops and reduced the growth and yield attributes and thereby reduced seed cotton yield. Application of pendimethalin (38.7% CS) 500 g/ha + oxyfluorfen 50 g/ha PE (Tank mix) *fb* pyrithiobac-sodium 62.5 g/ha + quizalofop-ethyl 50 g/ha PoE (Tank mix) recorded significantly higher number of bolls per plant (59.50), seed index (9.64 g) and seed cotton yield (3243 kg/ha) and remained at par with oxyfluorfen 100 g/ha PE *fb* glufosinate ammonium 375 g/ha PoE directed spray and IC + HW at 20, 40 (Table 2). This may be due to pre-emergence application of herbicides applied alone or mixtures (sequential and tank mixture) included in the study as well as mechanical methods of weed management were found effective in combating the weeds which in turn provide very less crop-weed competition at initial stage and hence, create the congenial condition for the crop for better utilization of available resources leads to higher nutrient uptake and better crop growth thereby yield parameters. These findings are in close vicinity with the findings of Siddagangamma and Channabasavanna (2018) [5], Patel *et al.* (2016) [6] and Madavi *et al.* (2017) [7]. The results also showed that none of the herbicides applied alone and as mixtures at tested dose had any residual toxic effect on succeeding summer groundnut in terms of dry weight of *Rhizobium* nodule/plant and pod yield. Further, there was no residual visual phytotoxicity was observed in succeeding groundnut crop. Similar line of results was also obtained by Madhvi and Ramprakash (2015) [4].

Table 1: Weeds and growth of *Bt*. cotton as influenced by different herbicides (Pooled over two years data)

Treatments	Total weed density (No./m^2) at harvest	Total weed dry weight (g/m^2) at harvest	WCE (%)	Plant height (cm)	Monopodial branches/ plant	Sympodial branches/ plant
T_1: Pendimethalin 750 g/ha (38.7% CS) PPI *fb* Glufosinate ammonium 375 g/ha PoE directed spray	6.11^{e} (36.33)	10.91^{d} (118.19)	73.97	186.82^{bc}	3.88^{b}	23.03^{bc}
T_2: Oxyfluorfen 100 g/ha PE *fb* Glufosinate ammonium 375 g/ha PoE directed spray	4.15^{f} (16.43)	6.44^{e} (40.77)	91.02	199.58^{ab}	4.23^{a}	24.03^{ab}
T_3: Pendimethalin 750 g/ha (30% EC) PE *fb* Glyphosate 2000 g/ha PoE directed spray	6.60^{cd} (42.68)	11.95^{c} (142.25)	68.67	181.94^{cd}	3.80^{bc}	22.68^{bcd}
T_4: Pendimethalin 750 g/ha (30% EC) PE *fb* Paraquat 600 g/ha PoE directed spray	8.07^{b} (64.23)	15.08^{b} (227.11)	49.98	170.32^{de}	3.48^{de}	21.20^{d}
T_5: Pendimethalin 1000 g/ha (30% EC) PE *fb* Pyrithiobac-sodium 62.5 g/ha + Quizalofop-ethyl 50 g/ha PoE (Tank mix)	6.59^{cd} (42.63)	12.13^{c} (146.50)	67.73	178.04^{cd}	3.73^{bcd}	22.40^{bcd}
T_6: Pendimethalin (38.7% CS) 500 g/ha + Oxyfluorfen 50 g/ha PE (Tank mix) *fb* Pyrithiobac-sodium 62.5 g/ha + Quizalofop-ethyl 50 g/ha PoE (Tank mix)	3.96^{f} (14.73)	5.88^{e} (33.72)	92.57	205.44^{a}	4.40^{a}	25.35^{a}
T_7: Pendimethalin 1000 g/ha (38.7% CS) PE *fb* IC + HW at 40 DAS	6.98^{c} (47.75)	12.64^{c} (158.87)	65.01	175.88^{cde}	3.55^{cde}	22.25^{cd}
T_8: Pyrithiobac-sodium 62.5 g/ha PoE + Quizalofop-ethyl 50 g/ha PoE (Tank mix) *fb* IC + HW at 50 DAS	6.31^{de} (38.88)	11.07^{d} (121.72)	73.19	163.77^{e}	3.38^{e}	16.65^{e}
T_9:IC + HW at 20, 40 and 60 DAS	3.88^{f} (14.10)	6.28^{e} (38.78)	91.46	196.85^{ab}	4.18^{a}	23.90^{abc}
T_{10}:Weedy Check	10.54^{a} (110.40)	21.30^{a} (454.01)	-	144.99^{f}	1.80^{f}	8.53^{f}
S.Em ±	0.12	0.23	-	3.94	0.09	0.51
CD (p<0.05)	0.36	0.66	-	11.38	0.25	1.57
CV (%)	5.74	5.87	-	6.29	6.91	7.44

Note: All figures are subjected to transformed values to square root (√x+1). Figures in parentheses indicate original values. Mean followed by common letter (s) in column are not significant by DNMRT at 5% level of significance

Table 2: Yield attributes, yield of *Bt*. cotton and residual effect on succeeding groundnut as influenced by different herbicides (Pooled over two years data)

Treatments	Bolls/ plant	Seed index (g)	Ginning (%)	Oil (%)	Seed cotton yield (kg/ha)	Groundnut nodules dry weight (mg/plant) at 40 DAS	Groundnut pod yield (kg/ha)
T_1: Pendimethalin 750 g/ha (38.7% CS) PPI *fb* Glufosinate ammonium 375 g/ha PoE directed spray	48.28^{b}	8.72^{bc}	37.00	18.19	2651^{b}	33.37	3046
T_2: Oxyfluorfen 100 g/ha PE *fb* Glufosinate ammonium 375 g/ha PoE directed spray	56.60^{a}	9.20^{ab}	36.45	18.26	3032^{a}	31.26	2966
T_3: Pendimethalin 750 g/ha (30% EC) PE *fb* Glyphosate 2000 g/ha PoE directed spray	47.78^{b}	8.61^{c}	36.80	18.17	2610^{b}	31.98	2949
T_4: Pendimethalin 750 g/ha (30% EC) PE *fb* Paraquat 600 g/ha PoE directed spray	43.55^{c}	8.20^{cde}	37.48	18.13	2344^{b}	31.37	2910
T_5: Pendimethalin 1000 g/ha (30% EC) PE *fb* Pyrithiobac-sodium 62.5 g/ha + Quizalofop-ethyl 50 g/ha PoE (Tank mix)	47.18^{bc}	8.51^{cd}	37.23	18.13	2545^{b}	31.27	2969
T_6: Pendimethalin (38.7% CS) 500 g/ha + Oxyfluorfen 50 g/ha PE (Tank mix) *fb* Pyrithiobac-sodium 62.5 g/ha + Quizalofop-ethyl 50 g/ha PoE (Tank mix)	59.50^{a}	9.64^{a}	36.10	18.34	3243^{a}	32.06	3007
T_7: Pendimethalin 1000 g/ha (38.7% CS) PE *fb* IC + HW at 40 DAS	46.15^{bc}	8.46^{cd}	37.21	18.11	2447^{b}	32.37	2943
T_8: Pyrithiobac-sodium 62.5 g/ha PoE + Quizalofop-ethyl 50 g/ha PoE (Tank mix) *fb* IC + HW at 50 DAS	36.78^{d}	8.04^{de}	37.55	18.08	1956^{c}	30.79	2932
T_9:IC + HW at 20, 40 and 60 DAS	55.98^{a}	9.16^{ab}	36.99	18.26	2973^{a}	33.37	3070
T_{10}:Weedy Check	23.98^{e}	7.71^{e}	37.60	18.02	940^{d}	31.92	2934
S.Em ±	1.25	0.17	0.58	0.11	96	1.63	109
CD (P<0.05)	3.72	0.50	NS	NS	294	NS	NS
CV (%)	7.96	5.83	4.72	1.74	11.40	10.20	10.78

Note: All figures are subjected to transformed values to square root (√x+1). Mean followed by common letter (s) in column are not significant by DNMRT at 5% level of significance

Conclusion

For effective weed management and higher seed cotton yield in *Bt.* cotton, pendimethalin (38.7% CS) 500 g/ha + oxyfluorfen 50 g/ha as PE (Tank mix) *fb* pyrithiobac-sodium 62.5 g/ha + quizalofop-ethyl 50 g/ha as PoE (Tank mix) or oxyfluorfen 100 g/ha as PE *fb* glufosinate ammonium 375 g/ha directed spray as PoE or interculturing and hand weeding at 20, 40 and 60 DAS can be adopted without any carry over effect on succeeding summer groundnut.

References

1. Ramachandra D, Ramamohan DG, Bhan A, Suresh PJ. Weed management in cotton: The potential of GM crops. Indian Journal of Weed Science. 2016;48(2):136-143.
2. Sondhia S. Herbicides residues in soil, water, plants and non-targeted organisms and human health implications: an Indian perspective. Indian Journal of Weed Science. 2014;46(1):66-85.
3. Kamble AB, Danawale NJ, Rajendrakumar. Integrated weed management in *Bt.* cotton. Indian Journal of Weed Science. 2017;49(4):405-08.
4. Madhavi M, Ramprakash T. Efficacy of herbicide mixture for weed management in *Bt.* cotton. 25th Asian-Pacific Weed Science Society Conference on Weed Science for Sustainable Agriculture, Environment and Biodiversity, Hyderabad, India during 13-16th October, 2015, 118.
5. Siddagangamma KR, Channabasavanna AS. A review on weed management in *Bt.* cotton. International Journal of Current Microbiology and Applied Sciences. 2018;7:900-913.
6. Patel BD, Chaudhari DD, Patel RB, Patel VJ. Comparative efficacy of different herbicides on *Bt.* cotton and their residual effect on succeeding crops. Research on Crops. 2016;17(1):106.
7. Madavi B, Rani LP, Sreenivas G, Surekha K. Impact of high density planting and weed management practices on growth parameters and phenology of *Bt.* cotton. International Journal on Current Microbiology and Applied Research. 2017;6(9):2360-2372.