FORM-B PROFORMA FOR PROPOSAL FOR THE RECOMMENDATION TO BE MADE

FOR FARMERS/SCIENTIFIC COMMUNITY

Rec	ommendation: 1	
1)	*Experiment No. and Title	17.2.3.84
	(Capital letters)	Influence of Glufosinate ammonium on cotton yield and soil microbes
2)	BH No.	(BH-12246)
3)	Collaborative department	RCRS, CoA, NAU, Bharuch
4)	Location and Agro-climatic sub-region	Regional Cotton Research Station, College of Agriculture, Bharuch Agro Climatic Zone II, Situation IV

5) Background information

Gujarat, Maharashtra and Telangana are the major cotton growing states contributing around 70% of the area and 67% of cotton production in India. Nandagavi and Halikatti (2016) highlighted that on an average, 40 to 85 % cotton yield can be reduced by weeds. Therefore, proper weed management practice is now the fundamental requisite for the cotton growers to address such drastic yield reduction. Hand weeding/interculture by far is the best and common conventional practice to manage weeds and consequently to increase yield and quality of cotton crop. However, in the present scenario, chemical measures of weed control is now gaining popularity among farmers as it is quick, economical and effective way to destroy weeds and contribute higher crop yield (Mirghasemi et al. 2012). In cotton, among several herbicidal applications, a contact herbicide, glufosinate ammonium is now receiving high attention and getting widely used for successful management of wide range of weed flora (Chompoo and Pornprom 2008) during critical crop weed competition period. However, chemical formulations always leave footprint on crop and soil since they are toxic in nature. Residual toxicity depends on chemical structure, formulation, dose, time and way of application of herbicides. Phytotoxic effect of herbicide on crop i.e. visual symptoms of chlorosis, wilting, scorching, necrosis, epinasty, hyponasty, yellowing etc. and impairment of soil biological activity through toxic substances are the major obstacles in use of chemical measures of weed control as their consequent effect is associated with growth and yield of the crop. Considering the above facts, an experiment will be executed to observe phytotoxic effects of glufosinate ammonium 13.5% SL (15% w/v) at different doses on cotton and soil micro-flora and their consequence on crop growth, yield and economics.

- 6) Objectives
 - 1. To study the weed flora of cotton
 - 2. To evaluate the efficiency of Glufosinate ammonium application on weed control and growth and yield of cotton
 - 3. To know the microbial status of soil and influenced under Glufosinate ammonium application

7)	Principal investigator & associates	:										
	Dr. T. U. Patel (PI) Prof. M.L. Patel (Co-PI) Dr. H. H. Patel Dr. D. D. Patel Dr. J.R. Pandya **Collaboration with Regional Cott	Assistant Professor (Agronomy) Assistant Research Scientist (Agronomy) Assistant Professor (Agronomy) Principal, Professor & Head (Agronomy) Assistant Professor (Plant Pathology) on Research Station, Bharuch										
8)	Experimental period	: From 2021-22 to 2023-24 (three years)										
9)	Season of experiment	: Kharif										
10)	Crop and Variety	: Cotton; G. Cot. Hy. 12 (BG-II)										
11)	Experimental details											
	a) Treatments	: Weed management										
	 W1 : Glufosinate amm W2 : Glufosinate amm W3 : Glufosinate amm HW and IC at 50 	nonium 13.5% SL (15% w/v) 350 g/ha as EPoE nonium 13.5% SL (15% w/v) 450 g/ha as EPoE nonium 13.5% SL (15% w/v) 350 g/ha as EPoE +										
	W ₄ : Glufosinate amm	13.5% SL (15% w/v) 450 g/ha as EPoE +										
	HW and IC at 50 W₅ · Pendimethalin 0	DAS 9 kg/ba PE fb Quizalofop-ethyl + Pyrithiobac										
	sodium (75+50 g	/ha ready mix) as PoE at 50 DAS										
	W ₆ : Weed free check	(HW and IC at 20, 40 and 60 DAS)										
	Note: Common hand weeding	was introduced before application of Glufosinate herbicide										
	to remove intrarow wee Glufosinate herbicides as	eds and inter row weeds were killed by application of per treatments.										
	b) Experimental Design	: Randomized Block Design										
	c) Replications	: Three (3)										
	d) Plot size (if applicable)	: Gross - 6.0 m x 4.5 m										
		Net - 3.6 m x 2.7 m										
	e) Spacing	: 120 cm X 45 cm										
	f) Seed rate (kg/ha)	: 2.5 kg/ha										
	g) Manuring											
	i) FYM (t/ha)	: 5 t/ha										
	ii) N, P and K (kg/ha)	: 120 kg N/ha										
	The required quantity of ure	urea was worked out and applied in two splits, 1/3										

The required quantity of urea was worked out and applied in two splits, 1/3 dose of nitrogen applied as basal and remaining tow dose of nitrogen was applied at 30-35 DAS interval as top dressings application. Full quantity of FYM was applied and mixed in soil at the time of land preparation.

12) Year-wise cultural details

a) Date of	2021-22	2022-23	2023-24
(i) Sowing :	July 2021	July 2021	July 2021

		(ii) Harvesting	: Feb. 2022 Feb. 2023 Feb. 2							
				2 pickings at an	average of 20 of	days interval				
	b)	Number of irrigations (Year-wise)	:	Rainfed						
	c)	Number of weedings	:	As per treatments						
	d)	Number of inter culturing	:	As per inter culturi	ng treatments					
	e)	Previous crop and Fertilizer applied		Cotton (80 kg N/ha	a)					
13)	So	il analysis (if applicable)		Initial						
		Items		2021-22	2022-23	2023-24				
	a)	рН	:	8.03	8.05	8.10				
	b)	EC	:	0.231	0.251	0.243				
	c)	Organic carbon	:	0.34	0.29	0.28				
	d)	Available N	:	212	206	210				
	e)	Available P2O5	:	31	26	33				
	f)	Available K ₂ O	:	478	473	459				
	g)	Any other		The initial soil wavery low in OC co in available N a medium available	as alkaline in ntent. The soil nd P₂O₅ cont K₂O content.	reaction with was deficient ent and had				
14)	Inp	out analysis		Not applicable						
15)	Ye	ar-wise general conditions								
	a)	Pest and diseases	:	No severe incide were observed Systemic insectici Flubendiamide 39.35 were sprayed to bollworm as and w	ence of pest a during the de (Imidacloprid SC (₹/lit.) and Ace control sucki /hen needed.	and diseases investigation. 17.8 SL (₹/lit.), ephate 75% S.P) ing pest and				
	b)	Plant stand	:	Normal during all t	he three years					
	c)	Seasonal conditions	:	Normal during all t	he three years					
	d)	Rainfall distribution	:	Normal during all t	he three years					
16)	Re (Ta an	esults able/s with statistical alysis and Interpretation)	:	Data pertaining to weeds, weed indic & yield attributes, are presented in ta	weed density, ces, plant popu seed yield ar able 1 to 18.	dry weight of llation, growth nd economics				

1. Weed studies

The data on weed studies viz., weed flora, weed population, dry weight of weeds, weed indices *i.e.* weed control efficiency and weed index at various growth stages are portrayed in table 1 to 6 and 7.

1.1 Weeds flora

Survey of the experimental field revealed that weedy check plots were heavily invaded by verities of weed species. Among monocot weeds, *viz.*, *Echinochloa crusgalli* L., *Echinochloa colona* L., *Digitaria sanguinalis* L., *Cynodon dactylon* L., *Brachiaria spp.*, *Commelina benghalensis* L. and *Dinebra retroflexa* L. While dicot weeds, *viz.*, *Digera arvensis* L., *Vernonia cinerea* L., *Amaranthus viridis* L, *Convolvulus arvensis* L., *Euphorbia hirta* L., *Tridax procumbens* L. *Trianthema portulacastrum* L., *Portulaca oleracea* L. and *Cyperus rotundus* L. *Cyperus iria* L. and *Cyperus compressus* L. the sedges were predominantly observed during the course of experimentation. In general, narrow leaf weeds (monocot and sedge) were dominantly observed during the experiment compared to dicots. Overall, total nineteen (19) weeds were observed in experimental posts, comprised seven (7) monocots, nine (9) dicots and three (3) sedges.

2. Weed population

The weed population of monocots, dicots, sedges and total weeds were counted from the experimental plots periodically (at 25 and 50 DAS) are described here under. It is evident from the three years experiment that weed management practices significantly altered the weed population and presented in table 2 to 6.

Overall, composition of monocot, dicot and sedges were 61.79, 21.87 and 16.34 per cent at 25 days after sowing, whereas 45.64, 38.72 and 15.64 per cent at 50 days after sowing. The trends indicated that monocots become dominant weeds, followed by dicots and sedges. The composition of monocot weeds decreased even the population was increased at 50 days after sowing because they are seed germinated plants and has strong intra competition. Besides, dicots are generally slow established and regenerated through both sexually as well as asexually that has some additional benefits with passage of time.

2.1 Monocot weeds (25 and 50 DAS)

The data on monocot weeds count differed significantly due to weed management treatments were recorded at 25 & 50 DAS which are presented in table 2.

Weed free check (HW and IC at 20, 40 and 60 DAS: W_6) recorded significantly the least number of monocot weeds (0.00 and $1.24/m^2$, respectively), while, maximum number of monocot weeds (48.50 and 55.42/m², respectively) was recorded with weedy check (W_7) during the individual years as well as in pooled at 25 and 50 DAS. Further, early post emergence application of Glufosinate (W_1 to W_4) and Pendimethalin *fb* Quizalofop ethyl+ Pyrithiobac sodium (W_5) also significantly minimized monocot weeds during individual years as well as in pooled.

2.2 Dicot weeds (25 and 50 DAS)

The data on dicot weeds count differed significantly due to weed management treatments were recorded at 25 & 50 DAS which are presented in table 3.

As usual, weed free check (HW and IC at 20, 40 and 60 DAS: W_6) recorded significantly the least number of dicot weeds (0.0 and 1.0/m², respectively) at 25 and

50 DAS, while, maximum number of dicot weeds (17.17 and $47.00/m^2$) were recorded with weedy check (W₇) during the individual years as well as in pooled. Similarly, application of herbicides (pre and post) also observed significant by devasting weeds from cotton field compared to control.

2.3 Sedges (25 and 50 DAS)

The data on sedges count differed significantly due to weed management treatments were recorded at 25 & 50 DAS which are presented in table 4.

Sedges population was reduced significantly under weed free condition (W₆) followed by Glufosinate (W1 to W4) at 25 days after sowing. Moreover, at 50 DAS, weed free recorded the lowest sedges, whereas significant reduction in sedges were also noted with herbicidal application than control, but failed to compared the best practices i.e. weed free. While, control (W₇) recorded maximum number of sedge weeds (12.83 and 19.00/m²) on pooed basis at 25 and 50 DAS, respectively.

2.2 Total weeds (25 and 50 DAS)

The data on total weeds count differed significantly due to weed management treatments were recorded at 25 & 50 DAS which are presented in table 5.

Individual species of weeds population reflected in total weed count and significantly the lowest number were recorded with weed free check (HW and IC at 20, 40 and 60 DAS: W_6) at 25 and 50 DAS (0.67 and 2.83/m², respectively). While, maximum number of total weeds (78.5 and 121.42/m², respectively) was recorded with weedy check (W_7) during the pooled analysis. Besides, application of Glufosinate either at 350 or 450 (W_1 to W_4) reduced the weeds significantly upto 25 days of application, onwards increments in total weeds were observed. Besides, application of pendimethalin (W_5) also control the total weeds significantly, whereas, population of weeds increased after 25 days because degradation of herbicide residue. The letter emerged weeds control by Pendimethalin *fb* Quizalofop ethyl+ Pyrithiobac sodium (W_5) and hand weeding (W_3 and W_4). Similar trends were followed during individual years also.

3 Dry weight of weeds at 50 DAS (g/m²) and at harvest (kg/ha)

The data on dry weight of weeds differed significantly due to weed management treatments were recorded at 50 DAS and at harvest which are presented in table 6.

Weed free check (HW and IC at 20, 40 and 60 DAS: W₆) at 50 DAS produced significantly the lowest weed dry biomass (1.78, 1.25, 1.00 and 0.75 g/m², respectively) during the individuals years and in pooled. While, maximum dry biomass of weeds (93.63, 97.00, 96.5 and 95.71 g/m², respectively) registered with weedy check (W₇). Further at harvest, significantly the least dry matter of weeds (119, 124, 115 and 119 kg/ha) was produced with weed free (HW and IC at 20, 40 and 60 DAS: W₆) followed by application of pendimethalin 0.9 kg/ha PE *fb* quizalofop-ethyl 50 g/ha + pyrithiobac sodium 75 g/ha (ready mix) at 50 DAS (W₅: 194, 200, 203 and 200 kg/ha), Glufosinate (450) + HW at 50 DAS (W₄: 275, 244, 261 and 260 kg/ha) and Glufosinate (350) + HW at 50 DAS (W₄: 284, 264, 277 and 275 kg/ha), whereas the highest was produced by weedy check (W₇: 1056, 1091, 1117 and 1088 kg/ha) during individual years as well as in pooled, respectively.

4 Plant population

Plant population as influenced by the various treatments of weed management recorded at 20 DAS and before harvest of crop from net plot area during the experimentation are presented in table 7.

It is evident from the three years experiment (Table 7) that crop establishment was found apparently uniform during the experimentation. Data also revealed that different herbicidal treatments and other weed management practices did not influence initial and final plant population. The result noticeably displayed that there was no adverse effect of the herbicides applied either as pre or post emergence on plant population because of protected spraying of non-selective herbicide i.e. Glufosinate. Therefore, it clearly indicates that the variations observed in the different parameters of weeds and yield of cotton during the course of investigations were the real effects of treatments only.

5 Plant height (cm)

Hight of cotton crop increased with progress of growth and influenced significantly under various treatments of weed management recorded at 45 and 90 DAS and before harvest of crop from net plot area during the experimentation are presented in table 8.

All the weed management treatments (W_1 to W_6) were found equally effective by recording significant higher plant height compared to weedy check as per pooled analysis at 45 DAS, through it was observed non-significant during individual years. Further, weed managed either thorough application of Glufosinate (350 or 450 g ai/ha) + HW at 50 DAS (W_3 and W_4) or pendimethalin 900 g ai/ha PE *fb* quizalofopethyl 50 g/ha + pyrithiobac sodium 75 g/ha (readyt mix) at 50 DAS (W_5) or IC with HW at 20, 40 and 60 DAS (W_6) significantly improved the plant height at 90 DAS and at harvest compared to rest of the weed management practices during individual years as well as in pooled.

6 Sympodial branches

Data pertaining to the effect of different weed management treatments on sympodial branches are presented in table 9.

Weed free check (IC and HW at 20, 40 and 60 DAS) significantly recorded the highest sympodial branches/plant during individual yeas as well as in pooled analysis, except second year, in which application Glufosinate 450 g ai/ha + HW and IC at 50 DAS recorded higher sympodial branches. While, weedy check registered lowest branches /plant. Pooled data indicating that treatment of W_3 to W_6 produced significantly higher sympodial branches than control i.e. W_7 : weedy check.

7 Balls/plant

Data pertaining to the effect of different weed management treatments on number of balls /plant are presented in table 9.

Weed free check (IC and HW at 20, 40 and 60 DAS: W_6) recorded significantly higher balls weight, being at par with pendimethalin 0.9 kg/ha PE *fb* quizalofop-ethyl 50 g/ha + pyrithiobac sodium 75 g/ha at 50 DAS (W_5), Glufosinate + HW and IC at

50 DAS (W_3 and W_4) during individual yeas as well as in pooled analysis, while weedy check registered minimum balls weight.

8 25 Balls weight (g)

Data pertaining to the effect of different weed management treatments on balls weight are presented in table 9.

Weed free check (IC and HW at 20, 40 and 60 DAS: W_6) recorded significantly higher balls weight, being at par with pendimethalin 0.9 kg/ha PE *fb* quizalofop-ethyl 50 g/ha + pyrithiobac sodium 75 g/ha at 50 DAS (W_5), Glufosinate + HW and IC at 50 DAS (W_3 and W_4) during individual yeas as well as in pooled analysis, while weedy check registered minimum balls weight.

9 Seed cotton yield (kg/ha)

An appraisal of data presented in table 10 cleared the significant influence on seed cotton yield due to weed management practices.

Significantly higher seed cotton yield was shown under HW and IC at 20, 40 and 60 DAS (W₆: 2193, 2250, 2179 and 2207 kg/ha, respectively) treatment, being at par with application of pendimethalin 0.9 kg/ha PE *fb* quizalofop-ethyl 50 g/ha + pyrithiobac sodium 75 g/ha as PoE (ready mix) at 50 DAS (W₅:2096, 2218, 2159 and 2158 kg/ha, respectively), Glufosinate + HW and IC at 50 DAS (W₄: 2072, 2135, 2147 and 2118 kg/ha) and Glufosinate + HW and IC at 50 DAS (W₃:2027, 2129, 2114 and 2096 kg/ha). Moreover, control (W₅: 1134, 1266, 1141 and 1180 kg/ha, respectively) produced significantly the least amount of seed cotton yield during individual years as well as in pooled.

10 Weed control efficiency

Data regarding to weed control efficiency (WCE) of various weed management was recorded at harvest and are presented in table 16.

Among the various weed management treatments, weed free (HW and IC at 20, 40 and 60 DAS) recorded maximum weed control efficiency i.e. 88.47 % followed by application of pendimethalin 0.9 kg/ha PE *fb* quizalofop-ethyl 50 g/ha + pyrithiobac sodium 75 g/ha as PoE (ready mix) at 50 DAS (W_5) that registered 82.41 % WCE, Glufosinate (450 g/ha) *fb* 1 HW and IC at 50 DAS (W_4 : 76.31%) and Glufosinate (350 g/ha) *fb* 1 HW and IC at 50 DAS (W_3 : 74.31%).

11 Weed index

Data pertaining to weed index under different weed management treatments are presented in table 7.

Treatment W_6 (HW and IC at 20, 40 and 60 DAS) was most effective by suppressing maximum weeds and also recorded maximum cotton yield. Hence, treatment W_6 was used to compare the other treatment to calculate the weed index. Data show that application of pendimethalin 0.9 kg/ha PE *fb* quizalofop-ethyl 50 g/ha + pyrithiobac sodium 75 g/ha as PoE (ready mix) at 50 DAS (W_5) recorded the lowest weed index (2.25 %). The next to treatment was Glufosinate (450 g/ha) *fb* 1

HW and IC at 50 DAS (W₄: 4.06%) and Glufosinate (350 g/ha) *fb* 1 HW and IC at 50 DAS (W₃: 5.03%) While, weedy check recorded maximum weed index and suppressed the cotton yield up to 46.53 per cent. It clearly reflects that weeds caused serious competition and caused losses upto 50 per cent in cotton.

12 Economics

The economics of different weed management treatments and the cost of cultivation of cotton crop along with current market worth of harvest and inputs are considered for calculation of specifying total cost of cultivation, gross realization, net realization and benefit: cost ratio (BCR) under various treatments of weed managements are furnished in table 10.

The highest net returns were obtained with application of pendimethalin 1.0 kg/ha PE *fb* quizalofop-ethyl 50 g/ha + pyrithiobac sodium 75 g/ha as PoE (ready mix) at 50 DAS (W₅: 65553 ₹/ha) followed by 3 HW and IC at 20, 40 and 60 DAS (W₆: 62547 ₹ /ha), Glufosinate (450 g/ha) *fb* 1 HW and IC at 50 DAS (W₄: 62358 ₹ /ha) and Glufosinate (350 g/ha) *fb* 1 HW and IC at 50 DAS (W₃: 61567₹ /ha) with B:C ratio of 2.23, 2.08, 2.25 and 2.15 respectively. However, weedy check (W₅) recorded the lowest net returns ₹ 20299 ₹/ha with B:C ratio 1.45.

13 Phytotoxicity on crop

Three years' experimental results delineated that there were no visible symptoms of yellowing, chlorosis, wilting, hyponasty/epinasty and scorching on cotton at 1, 3, 5, 7 and 10 DAA to exhibit phytotoxic effect of Glufosinate ammonium 13.5% SL (15% w/v) 350 and 450 g/ha (Tables 1 and 2) due to protective spraying of herbicides. However, phytotoxic effect of Glufosinate ammonium 13.5% SL (15% w/v) on the crop became observed due to drifting of herbicides. More or less visible symptoms of phytotoxicity were observed when Glufosinate ammonium 13.5% SL (15% w/v) 1800 g/ha was applied as weed control measure in cotton field. Specifically, based on the phytotoxicity rating scale (PRS), application of Glufosinate ammonium 13.5% SL (15% w/v) imposed 0-45% phytotoxic visible symptoms of yellowing/chlorosis; 0-26% of scorching; 0-18% wilting and 0-28% of hyponasty/epinasty on pooled basis.

Prominent phytotoxic effects of Glufosinate ammonium 13.5% SL (15% w/v) on cotton were gradually noticed from 1 DAA to 3, 5, 7 and 10 DAA. Control (weedy check) plot did not show any visible crop injury as it was kept apart from herbicidal application.

Phytotoxicity of glufosinate ammonium 13.5% on cotton through spray drift and root uptake from soil were prominent due to the non-selective, contact nature of the herbicide with some extent of systemic action. While application of Pendimethalin fb Quizalofop-ethyl + Pyrithiobac sodium not showed any phytotoxicity symptoms because both herbicides are selective for cotton crop.

14 Soil micro-flora (CFU/g)

Average of three years data (12 to 17) revealed that total microbial population was affected slightly, after the application of herbicides during the short period of time 2 DAA to 20 DAA with a range of $2.87-6.63 \times 10^6$ cfu/g of soil. The value of

microbes was found very much varied as compared to control (Weedy check). But 20 DAA there was an increasing in soil microbes with a range of 3.37-6.27 cfu/g in soil up to the harvest. During the soil micro-flora analysis there was little bit development of fungal colonies after 10 DAI. But the trend was as similar to total microbial population in different DAA as compared to control (weedy check.). Maximum bacterial colonies were noticed during the microbial analysis and the trend was also found similar to total microbial population. Bacterial population was found with a range of 2.87-6.53 cfu/g of soil at 2 DAA to 20 DAA. But 20 DAA there was a increasing in soil microbes with a range of 3.37-6.17 cfu/g of soil up to the harvest.

Overall, the study concluded that the application of herbicides may slightly affect the soil microbial population during the short period immediately after application, but this impact is temporary and the microbial population tends to increase back to normal levels or even little higher by the time of harvest. Therefore, there is no long-term adverse effect of herbicides on beneficial soil microbes.

15 Conclusion

In the light of the above results of three-year field experiment on weed management in cotton crop during *kharif* season, it can be summarized that

- Unweeded control cause yield loses up to 46.53 per cent in cotton crop.
- As usual, three HW and IC at 20, 40 and 60 DAS was most superior weed management option for higher productivity of cotton crop, however availability of labour and high wedges increases the cost of cultivation.
- Application of pendimethalin 0.9 kg/ha PE *fb* quizalofop-ethyl 50 g/ha + pyrithiobac sodium 75 g/ha (ready mix) at 50 DAS emerged as best weed management option to replaced monotonous HW practices (WI: 2.25%).
- Glufosinate ammonium 13.5 % SL applied at 350 g/ha as EPoE along with hand weeding for removal of intra row weeds followed by HW and IC at 50 DAS significantly reduced the population and dry weight of weeds (WI: 5.03%), besides reduce the labour requitement by (60%) and produced at par yield with weed free.
- Thus, it can be concluded that application of either pendimethalin 0.9 kg/ha PE *fb* quizalofop-ethyl 50 g/ha + pyrithiobac sodium 75 g/ha (ready mix) at 50 DAS or Glufosinate ammonium 13.5 % SL applied at 350 g/ha as EPoE along with hand weeding for removal of intra row weeds *fb* HW and IC at 50 DAS proved more remunerative and efficient in terms of weed management and higher seed cotton yield production.
- **16)** General recommendation for the farmers or scientists in English and Gujarati

Recommendation For Farmers

Farmers of South Gujarat Zone-II growing cotton during kharif season are advised to manage the weeds for obtaining higher and profitable production of cotton are as per below.

Application of pendimethalin EC 0.9 kg a.i./ha (3.00 kg/ha formulation) PE fb

quizalofop-ethyl 50 g a.i/ha + pyrithiobac sodium 75 g a.i./ha MEC (ready mix) at 50 DAS **OR** Glufosinate ammonium 13.5 % SL applied at 350 g/ha (2.33 kg/ha formulation, EPoE) as protected spray along with hand weeding for removal of intrarow weeds *fb* HW and IC at 50 DAS.

ખેડૂત ઉપયોગી ભલામણ

દક્ષિણ ગુજરાત (ખેત આબોઢવાકીય વિસ્તાર-૨) માં ચોમાસા દરમ્યાન કપાસ ઉગાડતા ખેડૂતોને કપાસનું વધુ તેમજ નજ્ઞાકારક ઉત્પાદન મેળવવા માટે નીચે મુજબ નીંદણ વ્યવસ્થાપન કરવાની ભલામણ છે.

કપાસની વાવણી બાદ તુરંત પેંડિમેથાલીન ૦.૯ કિગ્રા સ. ત. /હે (3.00 કિગ્રા/હે. બજારુ દવા) તથા ૫૦ દિવસે ક્વિઝાલોફોપ ઈથાઈલ + પાયરીથાયોબેક સોડિયમ ૫૦ + ૭૫ ગ્રામ સ. ત./હે (તૈયાર મિશ્રણ- ૧.૨૫ કિગ્રા/હે. બજારૂ દવા) નો છંટકાવ કરવો.

અથવા

વાવણીના બે અઠવાડીયા બાદ હાથ નીંદણ દ્વારા પાકની હારના નીંદણ દૂર કરી બે હાર વચ્ચે ગ્લુફોસિનેટ એમોનિયમ ૧૩.૫ % એસએલ ૩૫૦ ગ્રામ સ.ત. (૨.૩૩ કિગ્રા/હે. બજારુ દવા) નો કપાસના પાક ઉપર ન પડે એ રીતે રક્ષિત છંટકાવ કર્યા બાદ ૫૦ દિવસે હાથ નીંદણ સાથે આંતરખેડ કરવી.

Sr. No.	Botanical name	Habitat	RF (No. & %)				
[A]	Monocot weeds					25 DAS	50 DAS
1.	Echinochloa crusgalli L.	Barnyard grass	Sama	Gramineae	A,G,K		
2.	Echinochloa colona L.	Jungle rice	Banti	Gramineae	A,G,K		
3.	Cynodon dactylon L.	Bermuda grass	Dharo	Gramineae	P,G,K		
4.	Digitaria sanguinalis L.	Crabgrass	Arotaro	Gramineae	A,G,K	48.50 (61 79%)	55.42 (45 64%)
5.	Commelina benghalensis L.	Day flower	Shemul	Commelinaceae	A/P,H	(01.7370)	(+0.0+70)
6.	Brachiaria spp. L.	Para grass	Bharbhi	Gramineae	A,G,K		
7.	Dinebra retroflexa L.	Viper Grass	Panzer	Gramineae	A/P,G		
[B]	Dicot weeds	•		· · ·			
1.	Amaranthus viridis L.	Pigweed	Tandljo	Amaranthaceae	A,H,K		
2.	Convovulus arvensis L.	Field bindweed	Chandan vel	Convolvulaceae	P,H		
3.	Digera arvensis L.	False amaranth	Kanjaro	Amaranthaceae	A,H,K		
4.	Tidex procumbence L.	Coatbuttons	Ek dandi	Asteraceae	A,H,K		17.00
5.	Alternanthera sessilis L.	Alligator weed	Khakhi weed	Amaranthaceae	A/P,H,K	17.17 (21.87%)	47.00 (38 72%)
6.	Euphorbia hirta L.	Garden spurge	Dudheli	Euphorbiaceae	A,H,K	(21.07 /0)	(30.1270)
7.	Trianthema portulacastrum L.	Carpet weed	Satodo	Aizoaceae	A,H,K		
8.	Portulaca oleracea L.	Common purslane	Luni	Portulacaceae	A,H,K		
9.	Vernonia cinerea L.	Little iron weed	Fulakia	Compositeae	A,H,K		
[C]	Sedge						
1.	Cyperus rotundus L.	Purple nutsedge	Chidho	Cyperaceae	P,K	40.00	40.00
2.	Cyperus iria L.	Ricefield flatsedge	Chidho	Cyperaceae	A/P,K	12.83 (16 34%)	19.00 (15.64%)
3.	Cyperus compressus L.	Poorland flatsedge	Chidho	Cyperaceae	B,K		(10.0470)

Table 1. Predominant weed flora observed in experimental field

A-annual, P-perennial, G-grass, K-kharif, S-sedges, H-herb, RF-Relative frequency

Table2.	Monocot population/ m ² at 25 DAS as influenced by week	d management
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Trea	atment								Monoc	ot pop	ulations						
					(at 2	5 DAS)						(at 50	DAS)			
	(Dose g/ha)	1 st	year	2 nd	year	3 rd	year	Po	oled	1 st	year	2 nd	year	3 rd year		Pooled	
W 1	: Glufosinate (350)	1.18	(1.00)	1.06	(0.75)	1.18	(1.00)	1.14	(0.92)	6.41	(41.00)	5.68	(32.75)	5.98	(36.00)	6.02	(36.58)
W ₂	: Glufosinate (450)	1.18	(1.00)	1.18	(1.00)	1.06	(0.75)	1.14	(0.92)	5.64	(32.00)	5.72	(33.50)	5.56	(31.25)	5.64	(32.25)
W ₃	: Glufosinate (350) + HW & IC at 50 DAS	1.18 (1.00)		1.06	(0.75)	1.06	(0.75)	1.10	(0.83)	6.06	(37.50)	5.80	(33.50)	6.07	(37.25)	6.01	(36.42)
W ₄	: Glufosinate (450) + HW & IC at 50 DAS	1.10 (0.75)		1.06	(0.75)	0.97	(0.50)	1.04	(0.67)	5.52	(30.25)	5.90	(34.50)	5.83	(34.25)	5.71	(32.67)
W 5	: Pendimethalin (900) <i>fb</i> Quizalofop-ethyl + Pyrithiobac sodium (50+75)	2.99	(8.50)	3.34	(10.75)	3.19	(9.75)	3.17	(9.67)	4.56	(20.50)	3.10	(9.25)	3.10	(9.25)	3.58	(13.00)
W ₆	: Weed free check	1.10	(0.75)	0.71	(0.00)	0.71	(0.00)	1.22	(1.25)	1.01	(0.83)	1.26	(1.25)	1.33	(1.75)	1.24	(1.33)
W 7	: Weed check (control)	6.90	(47.25)	6.94	(48.00)	7.04	(50.25)	6.96	(48.50)	7.53	(56.50)	7.72	(59.25)	7.10	(50.5)	7.45	(55.42)
	SEm ±	0	.16	0.	23	0.	32	0	.14	0	0.43	0.	.40	0.	46	0).25
	CD at 5%		.48	0.	68	0.	94	0	.40	1	28	1	.19	1.	37	().70
	CV %	14	1.36	20	.95	28	.30	22	1.99	16	6.31	15	.90	18	.41	1	6.89
	Significant interaction		-		-		-	1	NS		-		-		-		NS

Trea	reatment		Dicot populations														
					(at	25 DAS	5)						(at 50	DAS)			
	(Dose g/ha)	1 st	year	2 nd	year	3 rd	year	Poo	oled	1 st	year	2 nd year		3 rd year		Pooled	
W 1	: Glufosinate (350)	1.06	(0.75)	1.00	(0.75)	1.06	(0.75)	1.04	(0.75)	4.46	(19.50)	4.59	(20.75)	4.70	(21.75)	1.04	(20.67)
W ₂	: Glufosinate (450)	0.97	(0.50)	0.93	(0.50)	1.06	(0.75)	0.98	(0.58)	4.39	(19.25)	4.43	(19.50)	4.65	(21.25)	0.98	(20.00)
W ₃	: Glufosinate (350) + HW & IC at 50 DAS	1.18 (1.00)		1.06	(0.75)	1.06	(0.75)	1.10	(0.83)	4.30	(18.00)	4.33	(18.75)	4.60	(20.75)	1.10	(19.17)
W ₄	: Glufosinate (450) + HW & IC at 50 DAS	0.93 (0.50)		0.93	(0.50)	1.06	(0.75)	0.97	(0.58)	4.23	(17.50)	4.35	(18.50)	4.51	(20.00)	0.97	(18.67)
W ₅	: Pendimethalin (900) <i>fb</i> Quizalofop-ethyl + Pyrithiobac sodium (50+75)	2.26 (4.75) 2.64 (6.50)		(6.50)	2.38	(5.25)	2.43	(5.50)	3.79	(14.00)	2.50	(6.00)	3.56	(12.25)	2.43	(10.75)	
W ₆	: Weed free check	0.71	(0.00)	0.71	(0.00)	0.71	(0.00)	0.71	(0.00)	1.27	(1.25)	1.26	(1.25)	0.97	(0.50)	0.71	(1.00)
W 7	: Weed check (control)	4.36	(18.50)	4.11	(16.50)	4.12	(16.5)	4.20	(17.17)	6.79	(45.75)	7.04	(49.25)	6.81	(46.00)	4.20	(47.00)
	SEm ±	0	.17	0	.19	0	.19	0.1	11	0	.26	0.	31	0.	19	().15
	CD at 5%	C	.51	0	.57	0	.56	0.3	30	0	.76	0.	91	0.	55	().42
	CV %	21.16 23.56		23.19		22.66		12.30		15.06		8.72		12.22			
	Significant interaction					-	N	NS		-		-		-	NS		

Table 3.Dicot population/ m² at 25 DAS as influenced by weed management

Trea	reatment		Sedge populations														
					(at	25 DA	S)						(at 50	DAS)			
	(Dose g/ha)	1 st	year	2 nd	year	3 rd	year	Poo	led	1 st	year	2 nd	year	3 rd year		Pooled	
W 1	: Glufosinate (350)	1.18	(1.00)	0.93	(0.50)	1.18	(1.00)	1.10	(0.83)	3.83	(14.25)	3.12	(10.00)	3.70	(13.25)	3.54	(12.50)
W ₂	: Glufosinate (450)	1.06	(0.75)	1.06	(0.75)	1.18	(1.00)	1.10	(0.83)	3.71	(13.50)	3.32	(11.00)	3.60	(12.50)	3.54	(12.33)
W ₃	: Glufosinate (350) + HW & IC at 50 DAS	1.18	(1.00)	1.06	(0.75)	1.18	(1.00)	1.14	(0.92)	3.51	(12.00)	3.57	(12.25)	3.62	(12.75)	3.58	(12.33)
W ₄	: Glufosinate (450) + HW & IC at 50 DAS	1.18 (1.00) 1.18		(1.00)	1.06	(0.75)	1.14	(0.92)	3.46	(11.50)	3.25	(10.25)	3.52	(12.00)	3.43	(11.25)	
W 5	: Pendimethalin (900) <i>fb</i> Quizalofop-ethyl + Pyrithiobac sodium (50+75)	2.27	(4.75)	2.22	(4.50)	1.92	(3.25)	2.14	(4.17)	3.12	(9.25)	1.48	(2.00)	2.91	(8.00)	2.49	(6.42)
W ₆	: Weed free check	0.71	(0.00)	0.71	(0.00)	0.71	(0.00)	0.71	(0.00)	0.84	(0.25)	1.26	(1.25)	0.71	(0.00)	0.95	(0.50)
W 7	: Weed check (control)	3.86	(14.5)	3.60	(12.50)	3.45	(11.50)	3.64	(12.83)	4.32	(18.25)	4.89	(23.50)	3.96	(15.25)	4.39	(19.00)
	SEm ±	0	.17	0	.18	0	.17	0.	10	0.	.18	0.	18	0.	31	C).14
	CD at 5%	0	.51	0	.53	0	.51	0.2	28	0.	.53	0.	54	0.	92	C).42
	CV %	20	20.84 23.06		22.39		22.07		10.86		11.08		16.22		14.20		
	Significant interaction					-	NS			-		-		-	Y X T		

Table 4.Sedge population/ m² at 25 DAS as influenced by weed management

Trea	atment	Total weeds populations															
					(at 25	5 DAS)							(at 5	0 DAS)			
	(Dose g/ha)	1 ^s	^t year	2 ^{nc}	ⁱ year	3 rd	year	Po	oled	1 st	year	2 nd year		3 rd year		Pooled	
W 1	: Glufosinate (350)	1.77	(2.75)	1.46	(2.00)	1.77	(2.75)	1.67	(2.50)	8.66	(74.75)	7.90	(63.50)	8.43	(71.00)	8.33	(69.75)
W ₂	: Glufosinate (450)	1.63	(2.25)	1.65	(2.25)	1.72	(2.50)	1.67	(2.33)	7.91	(63.05)	7.98	(64.00)	8.06	(65.00)	7.98	(64.02)
W ₃	: Glufosinate (350) + HW & IC at 50 DAS	1.86	(3.00)	(3.00) 1.54 (2.25		1.70	(2.50)	1.70	(2.58)	8.20	(67.50)	8.12	(65.50)	8.41	(70.75)	8.25	(67.92)
W4	: Glufosinate (450) + HW & IC at 50 DAS	1.59 (2.25)		1.61	(2.25)	1.54	(2.00)	1.58	(2.17)	7.85	(61.25)	7.91	(62.25)	8.15	(66.25)	7.97	(63.25)
W5	: Pendimethalin (900) <i>fb</i> Quizalofop-ethyl + Pyrithiobac sodium (50+75)	4.29	(18.00)	4.70	(21.75)	4.31	(18.25)	4.43	(19.33)	6.65	(43.75)	4.21	(17.25)	5.46	(29.50)	5.44	(30.17)
W ₆	: Weed free check	1.10	(0.75)	0.71	(0.00)	1.22	(1,25)	1.01	(0.67)	1.65	(2.50)	1.88	(3.75)	1.47	(2.25)	1.67	(2.83)
W 7	: Weed check (control)	8.98	(80.25)	8.79	(77.00)	8.82	(78.25)	8.86	(78.50)	10.99	(120.50)	11.49	(132.00)	10.56	(111.75)	11.01	(121.42)
	SEm ±	(D.18	C).25	C).31	0).15	C).39	C).43	().41	0.	24
	CD at 5%		0.53	C).75	C).93	0).42	1	.16	1	.26	1	1.21	0.	67
	CV %		1.76	1.	4.71	17.00		17.00		10.52		12.04		11.24		11.26	
Ot	Other significant interaction		-		-		-		NS		-		-		-	NS	

Table 5. Total weeds population/ m² at 25 DAS as influenced by weed management

Trea	Freatment		Dry weight of weeds														
					(at 50 D	AS, g/	′m²)					(at harve	est, kg/h	a)		
	(Dose g/ha)	1 ^s	^t year	2 nd	' year	3 rd	year	Р	ooled	1 st	year	2 nd year		3 rd year		Pooled	
W 1	: Glufosinate (350)	5.60	(31.25)	5.61	(31.50)	5.87	(34.25)	5.69	(32.33)	22.62	(512)	22.03	(488)	22.66	(517)	22.44	(505)
W ₂	: Glufosinate (450)	5.35	(28.25)	5.42	(29.25)	5.63	(31.50)	5.47	(29.67)	22.18	(493)	21.13	(447)	22.45	(506)	21.92	(482)
W ₃	: Glufosinate (350) + HW & IC at 50 DAS	5.43 (29.00)		5.46	(29.50)	5.58	(30.75)	5.49	(29.75)	16.85	(284)	16.16	(264)	16.61	(277)	16.54	(275)
W ₄	: Glufosinate (450) + HW & IC at 50 DAS	5.19 (27.00)		5.24	(27.50)	5.17	(27.00)	5.20	(27.17)	16.55	(275)	15.58	(244)	16.13	(261)	16.09	(260)
W ₅	: Pendimethalin (900) <i>fb</i> Quizalofop-ethyl + Pyrithiobac sodium (50+75)	4.31	(18.25)	4.03	(16.00)	4.07	(16.25)	4.14	(16.83)	13.88	(194)	14.16	(200)	14.20	(203)	14.08	(200)
W ₆	: Weed free check	1.51	(1.78)	1.27	(1.25)	1.14	(1.00)	1.31	(0.75)	10.85	(119)	10.99	(124)	10.69	(115)	10.84	(119)
W 7	: Weed check (control)	9.70	(93.63)	9.82	(97.00)	9.84	(96.50)	9.79	(95.71)	32.42	(1056)	32.78	(1091)	33.32	(1117)	32.84	(1088)
	SEm ±		0.27	C).41	C	.33		0.20	0	.84	1.	24	0.9	96	0	.59
	CD at 5%	(0.80	1	.21	C	.97		0.56	2	.49	3.	68	2.	86	1	.68
	CV %	1	10.39 15.50		1:	12.30		12.92		8.66		13.04		9.92		10.66	
Ot	Other significant interaction		-		-		-		NS	-						NS	

Table 6. Dry weight of weeds as influenced by weed management

Table 1. Weed mulces and plant population of collon as innuenced by weed manageme	Table 7. Weed indices and p	plant population of cotton as influenced by	/ weed managemer
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Treatment	Weed	indices	Plant population (No.)										
	(0)	%)	1 st y	/ear	2 nd	year	3 rd	year	Poo	oled			
(Dose g/ha)	WCE	WI	Initial	Final	Initial	Final	Initial	Final	Initial	Final			
W ₁ : Glufosinate (350)	41.41	28.50	16.75	16.00	17.25	16.75	17.00	16.25	17.00	16.33			
W₂ : Glufosinate (450)	45.49	27.77	16.50	16.50	16.75	16.25	16.75	16.00	16.67	16.25			
W₃ : Glufosinate (350) + HW & IC at 50 DAS	71.15	5.03	16.75	16.25	17.00	16.25	17.00	16.50	16.92	16.33			
W₄ :Glufosinate (450) + HW & IC at 50 DAS	73.06	4.06	16.75	16.50	17.25	16.50	16.75	17.00	16.92	16.67			
W₅ : Pendimethalin (900) <i>fb</i> Quizalofop- ethyl + Pyrithiobac sodium (50+75)	78.90	2.25	17.00	16.50	17.25	17.00	16.75	16.50	17.00	16.67			
W ₆ :Weed free check	84.70		17.25	17.00	15.75	15.50	16.75	16.75	16.58	16.42			
W7 : Weed check (control)		46.53	16.75	15.50	15.00	14.50	16.50	15.75	16.08	15.25			
SEm ±	-	-	0.71	0.67	1.02	1.06	0.62	0.54	0.46	0.46			
CD at 5%	-	-	NS	NS	NS	NS	NS	NS	NS	1.29			
CV %	-	-	8.45	8.21	12.25	13.20	7.41	6.54	9.58	9.70			
Other significant interaction	-	_	-	-	-		-	-	NS	NS			

Table 8. Plant height (c	cm) attributes of cotton as infl	uenced by weed management
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Treatment	Plant height (cm)												
		(at 45	DAS)			(at 90	DAS)			(at ha	rvest)		
(Dose/ha)	1 st year	2 nd year	3 rd year	Pooled	1 st year	2 nd year	3 rd year	Pooled	1 st year	2 nd year	3 rd year	Pooled	
W ₁ : Glufosinate (350)	46.20	47.55	48.90	47.55	95.35	96.05	96.05	95.82	124.75	126.50	119.00	123.42	
W₂ : Glufosinate (450)	47.70	46.45	50.30	48.15	96.65	94.00	98.65	96.43	124.00	129.50	118.25	123.92	
W ₃ : Glufosinate (350) + HW & IC at 50 DAS	47.10	47.30	47.05	47.15	108.60	109.00	114.25	110.62	145.20	142.60	143.10	143.63	
₩ ₄ : Glufosinate (450) + HW & IC at 50 DAS	47.85	48.45	48.45	48.25	109.45	110.10	113.80	111.12	147.45	149.75	149.25	148.82	
W₅ : Pendimethalin (900) <i>fb</i> Quizalofop-ethyl + Pyrithiobac sodium (50+75)	46.50	44.05	42.05	44.20	112.05	113.40	115.20	113.55	150.95	153.15	153.35	152.48	
W ₆ : Weed free check	48.70	49.35	47.55	48.53	114.90	111.70	116.30	114.30	152.90	156.05	156.05	155.00	
W7 : Weed check (control)	39.75	42.30	41.00	41.02	88.60	89.85	91.30	89.92	100.15	97.00	99.25	98.80	
SEm ±	2.39	2.00	2.37	1.30	4.68	4.94	4.96	2.81	7.45	6.32	5.63	3.76	
CD at 5%	NS	NS	NS	3.70	13.90	14.67	14.73	7.95	22.14	18.76	16.73	10.66	
CV %	10.32	8.62	10.18	9.74	9.02	9.55	9.31	9.30	11.04	9.26	8.40	9.63	
Other significant interaction	-	-	-	NS	-	-	-	NS	-	-	-	NS	

Treatment	S	Sympodia	a branch	1		Balls	/plant		Ba	alls weig	ht (25 no	o.)
(Dose/ha)	1 st year	2 nd year	3 rd year	Pooled	1 st year	2 nd year	3 rd year	Pooled	1 st year	2 nd year	3 rd year	Pooled
W ₁ : Glufosinate (350)	15.35	16.30	14.60	15.42	36.50	34.55	35.25	35.43	79.40	83.38	73.19	78.66
W₂ : Glufosinate (450)	15.60	17.90	15.05	16.18	37.50	36.80	38.75	37.68	80.08	87.06	74.90	80.68
W ₃ : Glufosinate (350) + HW & IC at 50 DAS	16.85	17.50	16.65	17.00	57.55	61.00	59.25	59.27	100.74	92.22	99.79	97.58
W₄ : Glufosinate (450) + HW & IC at 50 DAS	16.80	18.20	17.35	17.45	58.75	60.55	59.25	59.52	101.50	95.09	101.87	99.48
W₅ : Pendimethalin (900) <i>fb</i> Quizalofop-ethyl + Pyrithiobac sodium (50+75)	16.95	16.70	17.25	16.97	59.40	64.50	61.75	61.88	103.85	105.03	102.52	103.80
W ₆ : Weed free check	18.20	17.60	18.40	18.07	62.95	69.35	62.25	64.85	104.78	107.25	102.85	104.96
W7 : Weed check (control)	12.85	13.75	13.50	13.37	27.60	23.50	26.75	25.95	54.64	55.25	73.26	61.05
SEm ±	0.81	0.76	0.93	0.48	2.43	3.59	2.91	1.74	3.45	4.78	4.65	2.50
CD at 5%	2.41	2.25	2.77	1.37	7.22	10.66	8.64	4.93	10.25	14.20	13.82	7.10
CV %	10.07	8.99	11.58	10.23	9.99	14.34	11.87	12.24	7.73	10.70	10.36	9.69
Other significant interaction	-	-	-	NS	-	-	-	NS	-	-	-	NS

Table 9. Sympodial branch, balls/plant and balls weight of cotton as influenced by weed management

 Table 10. Seed cotton yield of cotton as influenced by weed management

Treatment	Seed cotton yield (kg/ha)					of produ (Rs. /ha)	ction	Realiz (Rs.	zation /ha)	BCR
(Dose/ha)	1 st year	2 nd year	3 rd year	Pooled	Fixed	Variable	Total	Gross	Net	
W ₁ : Glufosinate (350)	1554	1599	1582	1578	44614	4372	48986	86807	37821	1.77
W₂ : Glufosinate (450)	1581	1606	1597	1594	44614	4764	49378	87695	38317	1.78
W ₃ : Glufosinate (350) + HW & IC at 50 DAS	<u>2047</u>	<u>2129</u>	<u>2114</u>	<u>2096</u>	44614	9122	53736	115303	61567	2.15
W₄ : Glufosinate (450) + HW & IC at 50 DAS	<u>2072</u>	<u>2135</u>	<u>2147</u>	<u>2118</u>	44614	9514	54128	116486	62358	2.15
W₅ : Pendimethalin (900) <i>fb</i> Quizalofop-ethyl + Pyrithiobac sodium (50+75)	<u>2096</u>	<u>2218</u>	<u>2159</u>	<u>2158</u>	44614	8515	53129	118682	65553	2.23
W ₆ : Weed free check	2193	2250	2179	2207	44614	14250	58864	121411	62547	2.06
W7 : Weed check (control)	1134	1266	1141	1180	44614	0	44614	64913	20299	1.45
SEm ±	94.05	95.71	90.62	53.97	-	-	-	-	-	-
CD at 5%	279	284	269	153	-	-	-	-	-	-
CV %	10.39	10.15	9.82	10.12	-	-	-	-	-	-
Other significant interaction	-	-	-	NS		-	-	-	-	-

Tre	eatment	Plant	Yel	lowir	ng / C	hloro	osis		V	Viltin	g		Ну	pona	sty /E	Epina	sty		Sc	orch	ing	
	DAYS AFTER SOWING	/plot	1	3	5	7	10	1	3	5	7	10	1	3	5	7	10	1	3	5	7	10
W_1	: Glufosinate (350)	2.7	0.0	0.3	1.3	3.0	6.0	0.0	0.7	1.0	2.0	4.0	0.0	0.0	0.7	0.7	1.7	0.0	0.3	0.7	1.3	2.0
W2	: Glufosinate (450)	3.0	0.0	0.7	1.7	2.0	3.3	0.0	0.0	0.3	1.0	1.3	0.0	0.0	0.0	0.7	0.7	0.0	0.0	0.7	1.0	2.3
W ₃	: Glufosinate (350) + HW & IC at 50 DAS	2.0	0.0	1.3	2.0	3.7	4.3	0.0	0.0	0.7	1.3	1.3	0.0	1.0	2.0	3.3	3.3	0.0	0.3	0.3	1.7	2.3
W4	: Glufosinate (450) + HW & IC at 50 DAS	2.7	0.0	0.3	1.3	3.7	4.3	0.0	0.3	1.3	1.0	2.0	0.0	0.3	2.0	3.3	4.7	0.0	1.0	1.3	2.7	3.7
W5	: Pendimethalin (900) <i>fb</i> Quizalofop-ethyl + Pyrithiobac sodium (50+75)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W_6	: Weed free check	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
W_7	: Weed check (control)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 11. Phytotoxicity of herbicides on cotton plants (pooled)

Qualitative description of treatment effects on weeds and crop in the visual scoring scale of 0 to 10 (Rao, 1986)

Effect	Rating	Percent damage	Weed	Сгор
None	0	0.0	No control	No injury, normal
	1	0 t 10	Very poor control	Slight stunting, injury or discolouration
Slight	2	11 to 20	Poor control	Some stand loss, stunting or discolouration
	3	20 to 30	Poor to deficient control	Injury more pronounced but not persistent
	4	30 to 40	Deficient control	Moderate injury, recovery possible
Moderate	5	40 to 50	Deficient to moderate control	Injury more persistent, recovery doubtful
	6	51 to 60	Moderate control	Near severe injury no recovery possible
	7	61 to 70	Satisfactory control	Severe injury stand loss
Severe	8	71 to 80	Good control	Almost destroyed a few plants surviving
	9	81 to 90	Good to excellent control	Very few plants alive
Complete	10	91 to 100	Complete control	Complete destruction

Cfu/g of soil DAA 10 ⁶													
Treati	nent	Initial	2	4	6	8	10	20	30	40	50	60	Harvest
			YE	AR-I									
W ₁	Glufosinate (350)	5.1	4.8	4.6	3.4	3.7	3.6	3.5	3.9	4.3	4.7	5.1	6.1
W ₂	Glufosinate (450)	5.4	5.3	5.1	3.1	3.4	3.3	3.2	3.6	4.0	4.4	4.8	5.8
W ₃	Glufosinate (350) + HW & IC at 50 DAS	5.6	5.5	5.3	3.4	3.7	3.6	3.5	3.9	4.3	4.7	5.1	6.1
W_4	Glufosinate (450) + HW & IC at 50 DAS	6.8	6.7	6.5	3.6	3.9	3.8	3.7	4.1	4.5	4.9	5.3	6.3
W 5	Pendimethalin (900) <i>fb</i> Quizalofop-ethyl +	5.9	5.7	5.5	2.9	3.2	3.1	3.0	3.4	3.8	4.2	4.6	5.6
14/	Pyrithiobac sodium (50+75)	5 4	5.0	1.0	0.0		- - -	5.0	5.0				0.4
VV ₆		5.1	5.0	4.8	6.2	5.7	5.7	5.9	5.3	5.5	5.6	5.8	6.1
W 7	Weed check (control)	5.9	5.6	5.4	6.4	5.9	5.9	6.1	5.5	5.7	5.8	6.0	6.3
			YEA	AR-II	<u> </u>	<u> </u>							
W ₁	Glufosinate (350)	4.8	4.6	4.4	3.1	3.4	3.3	3.2	3.6	4.0	4.4	4.8	5.8
W ₂	Glufosinate (450)	5.1	4.9	4.7	2.8	3.1	3.0	2.9	3.3	3.7	4.1	4.5	5.5
W ₃	Glufosinate (350) + HW & IC at 50 DAS	5.3	5.1	4.9	3.1	3.4	3.3	3.2	3.6	4.0	4.4	4.8	5.8
W_4	Glufosinate (450) + HW & IC at 50 DAS	6.5	6.3	6.1	3.3	3.6	3.5	3.4	3.8	4.2	4.6	5.0	6.0
W5	Pendimethalin (900) <i>fb</i> Quizalofop-ethyl + Pyrithiobac sodium (50+75)	5.6	5.6	5.4	2.6	2.9	2.8	2.7	3.1	3.5	3.9	4.3	5.3
W ₆	Weed free check	4.8	4.7	4.5	5.9	5.4	5.4	5.6	5.0	5.2	5.3	5.5	5.8
W ₇	Weed check (control)	5.6	5.5	5.3	6.1	5.6	5.6	5.8	5.2	5.4	5.5	5.7	6.0
			YEA	R-III									
W ₁	GA 350 g/ha	5.3	5.0	4.8	3.6	3.9	3.8	3.7	4.1	4.5	4.9	5.3	6.3
W ₂	GA 450 g/ha	5.6	5.5	5.3	3.3	3.6	3.5	3.4	3.8	4.2	4.6	5.0	6.0
W ₃	GA 350 g/ha + Hw and IC at 50 DAS	5.8	5.6	5.4	3.6	3.9	3.8	3.7	4.1	4.5	4.9	5.3	6.3
W_4	GA 450 g/ha + Hw and IC at 50 DAS	7.0	6.9	6.7	3.8	4.1	4.0	3.9	4.3	4.7	5.1	5.5	6.5
W ₅	Pendi 0.9 kg/ha + Quiza 50 g/ha at 50 DAS + Pyri Sod 75 g/ha	6.1	6.0	5.8	3.1	3.4	3.3	3.2	3.6	4.0	4.4	4.8	5.8
W ₆	Weed free check (HW at 25 and 50 DAS)	5.3	5.2	5.0	6.4	5.9	5.9	6.1	5.5	5.7	5.8	6.0	6.3
W ₇	Weed check	6.1	5.6	5.4	6.6	6.1	6.1	6.3	5.7	5.9	6.0	6.2	6.5

Table 12. Total microbial population in soil as influenced by weed management in cotton

Cfu/g of soil DAA 10 ⁵													
Treati	nent	Initial	2	4	6	8	10	20	30	40	50	60	Harvest
			YE	AR-I									
W ₁	Glufosinate (350)	1	0	0	0	0	0	0	0	0	0	1	1
W ₂	Glufosinate (450)	3	1	1	0	0	0	0	0	0	0	0	2
W ₃	Glufosinate (350) + HW & IC at 50 DAS	2	1	3	0	0	0	0	0	0	0	1	1
W_4	Glufosinate (450) + HW & IC at 50 DAS	1	1	1	0	0	0	0	0	0	0	1	1
W ₅	Pendimethalin (900) fb Quizalofop-ethyl +												
	Pyrithiobac sodium (50+75)	2	2	2	0	0	0	0	0	0	0	0	3
W ₆	Weed free check	1	0	0	1	1	2	2	2	1	1	1	1
W ₇	Weed check (control)	2	1	1	2	2	1	1	3	1	1	1	2
			YEA	AR-II									
W ₁	Glufosinate (350)	0	0	0	0	0	0	0	0	0	0	0	1
W ₂	Glufosinate (450)	3	1	0	0	0	0	0	0	0	0	0	2
W ₃	Glufosinate (350) + HW & IC at 50 DAS	2	1	0	0	0	0	0	0	0	0	0	1
W ₄	Glufosinate (450) + HW & IC at 50 DAS	1	1	0	0	0	0	0	0	0	0	1	1
W 5	Pendimethalin (900) fb Quizalofop-ethyl +												
	Pyrithiobac sodium (50+75)												
		2	2	2	0	0	0	0	0	0	0	0	3
W ₆	Weed free check	0	0	0	1	1	2	2	2	1	1	1	1
W ₇	Weed check (control)	2	1	1	2	2	1	1	3	1	1	1	2
			YEA	R-III									
W ₁	GA 350 g/ha	1	0	0	0	0	0	0	0	0	0	0	0
W ₂	GA 450 g/ha	0	1	3	0	0	0	0	0	0	0	0	2
W ₃	GA 350 g/ha + Hw and IC at 50 DAS	2	1	1	0	0	0	0	0	0	0	3	1
W ₄	GA 450 g/ha + Hw and IC at 50 DAS	1	1	1	0	0	0	0	0	0	0	1	1
W ₅	Pendi 0.9 kg/ha + Quiza 50 g/ha at 50 DAS +												
	Pyri Sod 75 g/ha	2	2	2	0	0	0	0	0	0	0	0	3
W ₆	Weed free check (HW at 25 and 50 DAS)	3	2	0	1	1	2	2	2	1	1	1	1
W ₇	Weed check	2	1	1	2	2	1	1	3	1	1	1	2

Table 13. Total fungal population in soil as influenced by weed management in cotton

Trootm	ont					cfu/	/g of so	oil DAA	∖ 10 ⁶				
Heatin	ent	Initial	2	4	6	8	10	20	30	40	50	60	Harvest
			YEA	R-I									
W ₁	Glufosinate (350)	5.0	4.8	4.6	3.4	3.7	3.6	3.5	3.9	4.3	4.7	5.0	6.0
W ₂	Glufosinate (450)	5.1	5.2	5.0	3.1	3.4	3.3	3.2	3.6	4.0	4.4	4.8	5.6
W ₃	Glufosinate (350) + HW & IC at 50 DAS	5.4	5.4	5.0	3.4	3.7	3.6	3.5	3.9	4.3	4.7	5.0	6.0
W_4	Glufosinate (450) + HW & IC at 50 DAS	6.7	6.6	6.4	3.6	3.9	3.8	3.7	4.1	4.5	4.9	5.2	6.2
W_5	Pendimethalin (900) fb Quizalofop-ethyl +												
	Pyrithiobac sodium (50+75)	5.7	5.5	5.3	2.9	3.2	3.1	3.0	3.4	3.8	4.2	4.6	5.3
W 6	Weed free check	5.0	5.0	4.8	6.1	5.6	5.5	5.7	5.1	5.4	5.5	5.7	6.0
W 7	Weed check (control)	5.7	5.5	5.3	6.2	5.7	5.8	6.0	5.2	5.6	5.7	5.9	6.1
			YEA	R-II									
W 1	Glufosinate (350)	4.8	4.6	4.4	3.1	3.4	3.3	3.2	3.6	4.0	4.4	4.8	5.7
W ₂	Glufosinate (450)	4.8	4.8	4.7	2.8	3.1	3.0	2.9	3.3	3.7	4.1	4.5	5.3
W ₃	Glufosinate (350) + HW & IC at 50 DAS	5.1	5.0	4.9	3.1	3.4	3.3	3.2	3.6	4.0	4.4	4.8	5.7
W 4	Glufosinate (450) + HW & IC at 50 DAS	6.4	6.2	6.1	3.3	3.6	3.5	3.4	3.8	4.2	4.6	4.9	5.9
W 5	Pendimethalin (900) fb Quizalofop-ethyl +												
	Pyrithiobac sodium (50+75)	5.4	5.4	5.2	2.6	2.9	2.8	2.7	3.1	3.5	3.9	4.3	5.0
W_6	Weed free check	4.8	4.7	4.5	5.8	5.3	5.2	5.4	4.8	5.1	5.2	5.4	5.7
W ₇	Weed check (control)	5.4	5.4	5.2	5.9	5.4	5.5	5.7	4.9	5.3	5.4	5.6	5.8
			YEA	R-III									
W 1	GA 350 g/ha	5.2	5.0	4.8	3.6	3.9	3.8	3.7	4.1	4.5	4.9	5.3	6.3
W ₂	GA 450 g/ha	5.6	5.4	5.0	3.3	3.6	3.5	3.4	3.8	4.2	4.6	5.0	5.8
W ₃	GA 350 g/ha + Hw and IC at 50 DAS	5.6	5.5	5.3	3.6	3.9	3.8	3.7	4.1	4.5	4.9	5.0	6.2
W_4	GA 450 g/ha + Hw and IC at 50 DAS	6.9	6.8	6.6	3.8	4.1	4.0	3.9	4.3	4.7	5.1	5.4	6.4
W ₅	Pendi 0.9 kg/ha + Quiza 50 g/ha at 50 DAS +												
	Pyri Sod 75 g/ha	5.9	5.8	5.6	3.1	3.4	3.3	3.2	3.6	4.0	4.4	4.8	5.5
W ₆	Weed free check (HW at 25 and 50 DAS)	5.0	5.0	5.0	6.3	5.8	5.7	5.9	5.3	5.6	5.7	5.9	6.2
W 7	Weed check	5.9	5.5	5.3	6.4	5.9	6.0	6.2	5.4	5.8	5.9	6.1	6.3

Table 14. Total bacterial population in soil as influenced by weed management in cotton

Trootmo	nt.	cfu/g of soil DAA 10 ⁶												
Treatine		Initial	2	4	6	8	10	20	30	40	50	60	Harvest	
W ₁	Glufosinate (350)	5.07	4.80	4.60	3.37	3.67	3.57	3.47	3.87	4.27	4.67	5.07	6.07	
W ₂	Glufosinate (450)	5.37	5.23	5.03	3.07	3.37	3.27	3.17	3.57	3.97	4.37	4.77	5.77	
W ₃	Glufosinate (350) + HW & IC at 50 DAS	5.57	5.40	5.20	3.37	3.67	3.57	3.47	3.87	4.27	4.67	5.07	6.07	
W 4	Glufosinate (450) + HW & IC at 50 DAS	6.77	6.63	6.43	3.57	3.87	3.77	3.67	4.07	4.47	4.87	5.27	6.27	
W_5	Pendimethalin (900) fb Quizalofop-ethyl +	5.97	5 77	5 57	2 97	2 17	2.07	2.07	2 27	2 77	4 17	4 57	5 57	
	Pyrithiobac sodium (50+75)	5.07	5.77	5.57	2.07	3.17	3.07	2.97	3.37	3.77	4.17	4.57	5.57	
W_6	Weed free check	5.07	4.97	4.77	6.17	5.67	5.67	5.87	5.27	5.47	5.57	5.77	6.07	
W ₇	Weed check (control)	5.87	5.57	5.37	6.37	5.87	5.87	6.07	5.47	5.67	5.77	5.97	6.27	
Table 16	6. Total bacterial population in soil as influen	ced by we	ed ma	nagem	ent in	cotton	(poole	ed)						
W 1	Glufosinate (350)	5.00	4.80	4.60	3.37	3.67	3.57	3.47	3.87	4.27	4.67	5.03	6.00	
W ₂	Glufosinate (450)	5.17	5.13	4.90	3.07	3.37	3.27	3.17	3.57	3.97	4.37	4.77	5.57	
W ₃	Glufosinate (350) + HW & IC at 50 DAS	5.37	5.30	5.07	3.37	3.67	3.57	3.47	3.87	4.27	4.67	4.93	5.97	
W 4	Glufosinate (450) + HW & IC at 50 DAS	6.67	6.53	6.37	3.57	3.87	3.77	3.67	4.07	4.47	4.87	5.17	6.17	
W 5	Pendimethalin (900) fb Quizalofop-ethyl +													
	Pyrithiobac sodium (50+75)	5.67	5.57	5.37	2.87	3.17	3.07	2.97	3.37	3.77	4.17	4.57	5.27	
W ₆	Weed free check	4.93	4.90	4.77	6.07	5.57	5.47	5.67	5.07	5.37	5.47	5.67	5.97	
W ₇	Weed check (control)	5.67	5.47	5.27	6.17	5.67	5.77	5.97	5.17	5.57	5.67	5.87	6.07	
Table 17	7. Total fungal population in soil as influence	d by weed	l mana	gemen	it in co	tton (p	ooled))						
Troatmo	unt					cfu/	/g of so	oil DAA	<mark>۱0</mark> ⁵ ۱۸					
Treatme		Initial	2	4	6	8	10	20	30	40	50	60	Harvest	
W 1	Glufosinate (350)	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.67	
W ₂	Glufosinate (450)	2.00	1.00	1.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	
W ₃	Glufosinate (350) + HW & IC at 50 DAS	2.00	1.00	1.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.33	1.00	
W ₄	Glufosinate (450) + HW & IC at 50 DAS	1.00	1.00	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	
W ₅	Pendimethalin (900) fb Quizalofop-ethyl +													
	Pyrithiobac sodium (50+75)	2.00	2.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00	
W ₆	Weed free check	1.33	0.67	0.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00	1.00	
W ₇	Weed check (control)	2.00	1.00	1.00	2.00	2.00	1.00	1.00	3.00	1.00	1.00	1.00	2.00	

 Table 15. Total microbial population in soil as influenced by weed management in cotton (pooled)

Table 18: Herbicides residue analysis

Treatment		Sample details	Simple ID	Results (mg/kg)	Quantification limit
W ₃	Glufosinate (350) + HW & IC at 50 DAS	Cotton seeds	FTQL/C-001/08/2023	BQL	0.001
	:	Lint	FTQL/C-002/08/2023	BQL	0.001
W_4	:Glufosinate (450) + HW & IC at 50 DAS	Cotton seeds	FTQL/C-003/08/2023	BQL	0.001
	-	Lint	FTQL/C-004/08/2023	BQL	0.001
W5	:Pendimethalin (900) <i>fb</i> Quizalofop-ethyl + Pyrithiobac sodium (50+75)	Cotton seeds	FTQL/C-005/08/2023	BQL	0.001
		Lint	FTQL/C-006/08/2023	BQL	0.001