Int.J.Curr.Microbiol.App.Sci (2019) *8*(10): 261-267

International Journal of Current Microbiology and Applied Sciences
***ISSN: 2319-7706* Volume 8 Number 10 (2019)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2019.810.027

Influence of Weed Management Practices on Uptake of Nutrients by *Kharif* Sorghum [*Sorghum bicolor* (L.) Moench] and its Effect on Soil Fertility Status

S. S. Vinayaka[1], D. Krishnamurthy[1]*, A. S. Channabasavanna[2], Y. M. Ramesha[3] and Manjunath Bhanuvalli[4]

[1]Department of Agronomy, AICRP on Sorghum, ARS, Hagari, India
[2]Department of Agronomy, Directorate of Research, UAS, Raichur, India
[3]Department of Agronomy, ARS, Dhadesugur, India
[4]Department of Soil Science, Agricultural Extension Education Centre, Hadagali, University of Agricultural Sciences, Raichur-584 104, India

**Corresponding author*

Keywords

Polebean, Tillage, Nutrient uptake and microbial population

Article Info

Accepted:
04 September 2019
Available Online:
10 October 2019

A B S T R A C T

A field experiment was conducted at Agricultural Research Station, Hagari, Ballari during *Kharif* season of 2018on deep black soil. The experiment was laid out in randomized block design and repeated thrice with twelve treatments. Significantly higher uptake of nitrogen, phosphorus and potassium (219, 56.5 and 147.4 kg ha^{-1}) was recorded with atrazine 50 WP @ 0.50 a.i. kg ha^{-1}fb 2,4-D Ethyl Ester 38 EC @ 0.90 a.i. kg ha^{-1} as PoE at 30 DAS and it was on par with hand weeding at 20 DAS and 1 IC at 40 DAS (215, 55.2, and 145.7 kg ha^{-1}, respectively) and 2,4-D Ethyl Ester 38 EC @ 0.90 kg a.i. ha^{-1} as PoE at 30 DAS fb 1 IC at 40 DAS (211, 54.9, and 143.7 kg ha^{-1}, respectively. Nitrogen, phosphorous and potassium availability in the soil was significantly higher with weed free (IC at 20 & 40 DAS and HW at 30 DAS) (194, 47.6, and 219.9 kg ha^{-1}, respectively) treatment. Among other weed management practices, sequential pre-emergence application of atrazine 50 WP @ 0.50 kg a.i. ha^{-1} fb 2,4-D Ethyl Ester 38 EC @ 0.90 kg a.i. ha^{-1} as PoE at 30 DAS recoded significantly higher availability of nitrogen, phosphorous and potassium in the soil (177, 42.2, and 213.8 kg ha^{-1}, respectively) and it was on par with hand weeding at 20 DAS and 1 IC at 40 DAS (173, 41.7, and 212.1 kg ha^{-1}, respectively) and 2,4-D Ethyl Ester 38 EC @ 0.90 kg a.i. ha^{-1} as PoE at 30 DAS fb 1 IC at 40 DAS (170, 39.9, and 211.9 kg ha^{-1}, respectively).

Introduction

Sorghum is one of the important dryland crop grown in poor lands with minimum inputs and in dry conditions that tolerate to heat, salt and water-logging. Sorghum is a preferred in tropical, warm and semiarid regions of the world with high temperature and water stress

with the threat of climate change looming large on the crop productivity, sorghum is hardy crop that plays an important role in food, feed and fodder security in dryland economy (Paterson *et al.*, 2009). Sorghum is a smart crop capable of providing raw material for the making of starch, fibre, dextrose syrup, biofuels, alcohol and other goods especially under moderate inputs and water deficit environments (Mehmood *et al.*, 2008).

Ever increasing use of fertilizers and irrigation water, weed management has assumed significant importance in modern intensive farming, as the total loss of crop yield with increasing cost of cultivation causes a greater economic loss to the farmers (Aravadiya *et al.*, 2012).

The extent of yield loss due to weeds primarily depends on the composition of weed flora, period of crop-weed-competition and its intensity. Weeds reduce the crop yields crop yield by competing with light, water, nutrients and carbon dioxide. Effect of weeds and weed management on uptake of nutrients and its effect on soil fertility status is scanty.

Therefore present experiment was planned to study the Influence of weed management practices on uptake of nutrients by kharif sorghum and its effect on soil fertility status.

Materials and Methods

A field experiment entitled "Influence of weed management practices on uptake of nutrientsby *kharif* sorghum [*Sorghum bicolor* (L.) Moench] and its effect on soil fertility status" was conducted at Agricultural Research Station, Hagari, Ballari during *kharif* 2018. Agricultural Research Station, Hagari, Ballari is located on 15^{o} 14' N latitude and 77^{o} 07' E longitude with an altitude of 414 meters above the mean sea level and is located in Northern Dry Zone of Karnataka (Zone-III). The soil of the experimental field was clayey in texture. The soil available nutrient status showed medium availability of nitrogen (262.00 kg ha^{-1}), medium in available phosphorus (39.25 kg ha^{-1}) and high in available potassium (307.00 kg ha^{-1}). The organic carbon content was low to medium (5.1 g kg^{-1}). Twelve treatments comprising of weed management practices *viz.*, T_1: Atrazine 50 WP @ 0.50 kg a.i. ha^{-1} as PE, T_2: Atrazine 50 WP @ 0.50 kg a.i. ha^{-1} as PE fb 1 IC at 40 DAS, T_3: Pendimethalin 38.7 CS @ 0.6773 kg a.i. ha^{-1} as PE, T_4: Pendimethalin 38.7 CS @ 0.6773 kg a.i. ha^{-1} as PE fb 1 IC at 40 DAS, T_5: Atrazine 50 WP @ 0.25 kg a.i. ha^{-1} + Pendimethalin 38.7 CS @ 0.3387 kg a.i. ha^{-1} (Tank mix) as PE, T_6: Atrazine 50 WP @ 0.25 kg a.i. ha^{-1} + Pendimethalin 38.7 CS @ 0.3387 kg a.i. ha^{-1} (Tank mix) as PE fb 1 IC at 40 DAS, T_7: 2,4-D Ethyl Ester 38 EC @ 0.90 kg a.i. ha^{-1} as PoE at 30 DAS, T_8: 2,4-D Ethyl Ester 38 EC @ 0.90 kg a.i. ha^{-1} as PoE at 30 DAS fb 1 IC at 40 DAS, T_9: Atrazine 50 WP @ 0.50 kg a.i. ha^{-1} as PE fb 2,4-D Ethyl Ester 38 EC @ 0.90 kg a.i. ha^{-1} as PoE at 30 DAS, T_{10}: Hand weeding at 20 DAS and 1 IC at 40 DAS, T_{11}: Weed free (IC at 20 & 40 DAS and HW at 30 DAS), T_{12}: Weedy check were evaluated in randomized block design with three replications.

The composite soil samples from 0 to 15 cm depth were collected before planting and at harvest. Soils were air dried in shade, powdered and passed through 2 mm sieve and analysed for pH, EC, OC, available N, P_2O_5 and $K_2O_5$by following the methods described by Jackson (1973).The seeds of CSH-25 @ 7.5 kg ha^{-1} were sown at the spacing of 45 cm X 15 cm and the recommended package of practices were adopted for crop production.

The crop was harvested at its physiological maturity. The data was statistically analysed as per the procedure given by Panse and Sukhatme (1967).

Results and Discussion

Uptake of nutrients

Significantly higher nitrogen, phosphorus and potassium uptake (219, 56.5 and 147.4 kg ha^{-1}, respectively) was recorded with pre-emergence application of atrazine 50 WP @ 0.50 kg a.i. ha^{-1}fb 2,4-D Ethyl Ester 38 EC @ 0.90 kg a.i. ha^{-1} as PoE at 30 DAS and it was on par with hand weeding at 20 DAS and 1 IC at 40 DAS (215, 55.2, and 145.7 kg ha^{-1}, respectively) and 2,4-D Ethyl Ester 38 EC @ 0.90 kg a.i. ha^{-1} as PoE at 30 DAS fb 1 IC at 40 DAS (211, 54.9, and 143.7 kg ha^{-1}, respectively) (Table 1). Whereas, significantly lower uptake of nitrogen, phosphorus and potassium was observed with weedy check (129, 35.7 and 95.4 kg ha^{-1}, respectively) as compared to other treatments (Table 2).

This is due to lower crop weed competition results in better dry matter production in crop this ultimately results in higher uptake of nutrients. Whereas, the lowest uptake of nitrogen, phosphorus and potassium by maize crop was recorded in unweeded control as a result of weed competition resulting in lower dry matter production.

These results corroborate the results of Priya and Kubsad (2013) in sorghum and also by Sreenivas and Satyanarayana (1994).

Soil fertility status

Nitrogen, phosphorus and potassium availability in the soil after harvest of *kharif* sorghum crop was significantly influenced by different weed management practices (Table 2).

Significantly higher available nitrogen, phosphorus and potassium in the soil were recorded with weed free (IC at 20 & 40 DAS and HW at 30 DAS) (194, 47.6, and 219.9 kg ha^{-1}, respectively). Among other weed management treatments, sequential application of pre-emergence herbicide atrazine 50 WP @ 0.50 kg a.i. ha^{-1}fb 2,4-D Ethyl Ester 38 EC @ 0.90 kg a.i. ha^{-1} as PoE at 30 DAS recorded significantly higher availability of nitrogen, phosphorus and potassium in the soil (177, 42.2, and 213.8 kg ha^{-1}, respectively) and it was on par with hand weeding at 20 DAS and 1 IC at 40 DAS (173, 41.7, and 212.1 kg ha^{-1}, respectively) and 2,4-D Ethyl Ester 38 EC @ 0.90 kg a.i. ha^{-1} as PoE at 30 DAS fb 1 IC at 40 DAS (170, 39.9, and 211.9 kg ha^{-1}, respectively).

Significantly lower content of available nitrogen, phosphorus and potassium was noticed with weedy check (129, 26.9 and 152.0 kg ha^{-1}, respectively) compared to other treatments. These results are in corroboration with findings of Verma *et al.,* (2017).

Residual effect of herbicides on succeeding chickpea crop

The germination percentage, plant height and number of branches of chickpea were recorded at 45 DAS and found that, treatments did not differ significantly (Table 3). The sorghum - chickpea is the prominent sequence in the experimental area.

Hence, the residual effects of these treatments were studied on chickpea by bioassay studies (germination test) and the crop was examined for its growth parameters like plant height and branches in main field.

The data showed that non-significant differences between chemical weed management practices and non-chemical treated plots (hand weeding, weed free and weedy check) indicating no adverse effect of applied herbicides on succeeding crop and confirmed no residual effect of the herbicides tried in the experiment.

Table.1 Nitrogen, phosphorus and potassium uptake by *kharif* sorghum as influenced by different weed management practices at harvest

Treatments	Uptake of nutrients (kg ha^{-1})		
	Nitrogen	Phosphorus (P_2O_5)	Potassium (K_2O)
T_1 : Atrazine 50 WP @ 0.50 kg a.i. ha^{-1} as PE	181	45.0	120.4
T_2 : Atrazine 50 WP @ 0.50 kg a.i. ha^{-1} as PE fb one IC at 40 DAS	204	49.0	138.2
T_3 : Pendimethalin 38.7 CS @ 0.6773 kg a.i. ha^{-1} as PE	139	41.2	101.5
T_4 : Pendimethalin 38.7 CS @ 0.6773 kg a.i. ha^{-1} as PE fb one IC at 40 DAS	170	42.9	118.6
T_5 : Atrazine 50 WP @ 0.25 kg a.i. ha^{-1} + Pendimethalin 38.7 CS @ 0.3387 kg a.i. ha^{-1} (Tank mix) as PE	158	41.4	109.1
T_6 : Atrazine 50 WP @ 0.25 kg a.i. ha^{-1} + Pendimethalin 38.7 CS @ 0.3387 kg a.i. ha^{-1} (Tank mix) as PE fb one IC at 40 DAS	169	46.1	116.9
T_7 : 2,4-D Ethyl Ester 38 EC @ 0.90 kg a.i. ha^{-1} as PoE at 30 DAS	191	48.4	125.3
T_8 : 2,4-D Ethyl Ester 38 EC @ 0.90 kg a.i.ha^{-1} as PoE at 30 DAS fb one IC at 40 DAS	211	54.9	143.7
T_9 : Atrazine 50 WP @ 0.50 kg a.i. ha^{-1} as PE fb 2,4-D Ethyl Ester 38 EC @ 0.90 kga.i. ha^{-1} as PoE at 30 DAS	219	56.5	147.4
T_{10} : HW at 20 DAS and one IC at 40 DAS	215	55.2	145.7
T_{11}:Weed free (IC at 20 & 40 DAS and HW at 30 DAS)	235	61.9	159.4
T_{12}:Weedy check	129	35.7	95.4
S.Em±	**2.8**	**0.9**	**1.7**
C.D. (P=0.05)	**8.1**	**2.7**	**5.0**

Note:

WP: Wettable powder **PE:** Pre-emergence **fb:** Followed by **HW:** Hand weeding **PoE:** Post emergence

IC: Inter cultivation **DAS:** Days after sowing **CS**: Capsulated suspension **EC:** Emulsified concentrate

Table.2 Effect of different weed management practices on available NPK content in soil after harvest of *kharif* sorghum

Treatments	Available nutrients (kg ha^{-1})		
	Nitrogen	Phosphorus (P_2O_5)	Potassium (K_2O)
T_1 : Atrazine 50 WP @ 0.50 kg a.i. ha^{-1} as PE	153	35.5	191.1
T_2 : Atrazine 50 WP @ 0.50 kg a.i. ha^{-1} as PE fb one IC at 40 DAS	159	37.5	205.6
T_3 : Pendimethalin 38.7 CS @ 0.6773 kg a.i. ha^{-1} as PE	134	27.1	170.3
T_4 : Pendimethalin 38.7 CS @ 0.6773 kg a.i. ha^{-1} as PE fb one IC at 40 DAS	145	31.3	179.0
T_5 : Atrazine 50 WP @ 0.25 kg a.i. ha^{-1} + Pendimethalin 38.7 CS @ 0.3387 kg a.i. ha^{-1} (Tank mix) as PE	141	30.0	174.3
T_6 : Atrazine 50 WP @ 0.25 kg a.i. ha^{-1} + Pendimethalin 38.7 CS @ 0.3387 kga.i. ha^{-1} (Tank mix) as PE fb one IC at 40 DAS	148	33.9	179.9
T_7 : 2,4-D Ethyl Ester 38 EC @ 0.90 kg a.i. ha^{-1} as PoE at 30 DAS	155	37.1	194.4
T_8 : 2,4-D Ethyl Ester 38 EC @ 0.90 kg a.i.ha^{-1} as PoE at 30 DAS fb one IC at 40 DAS	170	39.9	211.9
T_9 : Atrazine 50 WP @ 0.50 kg a.i. ha^{-1} as PE fb 2,4-D Ethyl Ester 38 EC @ 0.90 kga.i. ha^{-1} as PoE at 30 DAS	177	42.2	213.8
T_{10} : HW at 20 DAS and one IC at 40 DAS	173	41.7	212.1
T_{11}:Weed free (IC at 20 & 40 DAS and HW at 30 DAS)	194	47.6	219.9
T_{12}:Weedy check	129	26.9	152.0
S.Em±	**2.6**	**1.5**	**1.3**
C.D. (P=0.05)	**7.6**	**4.4**	**3.8**

Note:

WP: Wettable powder **PE:** Pre-emergence **fb:** Followed by **HW:** Hand weeding **PoE:** Post emergence

IC: Inter cultivation **DAS:** Days after sowing **CS**: Capsulated suspension **EC:** Emulsified concentrate

Table.3 Germination percentage, plant height and number of branches per plant of succeeding chickpea at 45 DAS as influenced by different weed management practices in *kharif* sorghum

Treatments	Germination (%)	Plant height (cm)	Number of branches plant^{-1}
T_1 : Atrazine 50 WP @ 0.50 kg a.i. ha^{-1} as PE	88	18.81	3.7
T_2 : Atrazine 50 WP @ 0.50 kg a.i. ha^{-1} as PE fb one IC at 40 DAS	86	18.33	3.3
T_3 : Pendimethalin 38.7 CS @ 0.6773 kg a.i. ha^{-1} as PE	87	18.00	3.5
T_4 : Pendimethalin 38.7 CS @ 0.6773 kg a.i. ha^{-1} as PE fb one IC at 40 DAS	87	18.19	3.9
T_5 : Atrazine 50 WP @ 0.25 kg a.i. ha^{-1} + Pendimethalin 38.7 CS @ 0.3387 kg a.i. ha^{-1}(Tank mix) as PE	87	19.58	3.9
T_6 : Atrazine 50 WP @ 0.25 kg a.i. ha^{-1} + Pendimethalin 38.7 CS @ 0.3387 kga.i. ha^{-1} (Tank mix) as PE fb one IC at 40 DAS	88	18.33	3.3
T_7 : 2,4-D Ethyl Ester 38 EC @ 0.90 kg a.i. ha^{-1} as PoE at 30 DAS	88	18.38	3.4
T_8 : 2,4-D Ethyl Ester 38 EC @ 0.90 kg a.i.ha^{-1} as PoE at 30 DAS fb one IC at 40 DAS	87	18.71	3.8
T_9 : Atrazine 50 WP @ 0.50 kg a.i. ha^{-1} as PE fb 2,4-D Ethyl Ester 38 EC @ 0.90 kga.i. ha^{-1} as PoE at 30 DAS	88	19.38	3.7
T_{10} : HW at 20 DAS and one IC at 40 DAS	90	19.05	3.6
T_{11}:Weed free (IC at 20 & 40 DAS and HW at 30 DAS)	90	20.67	4.0
T_{12}:Weedy check	89	18.00	3.6
S.Em±	**0.9**	**2.0**	**0.7**
C.D. (P=0.05)	**NS**	**NS**	**NS**

Note:

WP: Wettable powder **PE:** Pre-emergence **fb:** Followed by **HW:** Hand weeding **PoE:** Post emergence

IC: Inter cultivation **DAS:** Days after sowing **CS**: Capsulated suspension **EC:** Emulsified concentrate

Jayakumar *et al.*, (2003) obtained similar results in sorghum. The results of the investigation revealed that significantly higher uptake of nutrients by *kharif* sorghum and available nitrogen, phosphorus and potassium in soil were recorded with Pre-emergence application of atrazine 50 WP @ 0.50 kg a.i. ha^{-1}fb 2,4-D Ethyl Ester 38 EC @ 0.90 kg a.i. ha^{-1} as PoE at 30days after sowing and no significance phytotoxic effect was recorded in succeeding chickpea crop on various growth attributes.

References

Arvadiya, L. K., Raju, V.C., Patel, T.U. and Aravadiya, M.K., 2012, Influence of plant population and weed management on weed flora and productivity of sweet corn (zea mays L.). *Indian J. Agron.*, 57(2): 162-167.

Jackson, M. L., 1973, *Soil Chemical Analysis*. Prentice hall of India (Pvt.), New Delhi, pp. 67-214.

Jayakumar, R., Ali, A. M. and Subramanian, S., 2003. Studies on residues of herbicides applied in cotton (*Gossypium hirsutum* L.) by bioassay techniques. *Pesticide Res. J.*, 14(3): 263-267.

Panse, V. G. and Sukhatme, P. U., 1967, *Statistical Methods for Agricultural Workers.*ICAR, New Delhi.

Priya, H. R. and Kubsad, V. S., 2013. Integrated weed management in rainy season sorghum (*Sorghum bicolor* L.). *Indian J. Agron.*, 58(4): 548-553.

Verma, B. R., Virdia, H. M. and Dinesh, K., 2017. Effect of Integrated weed management on yield, quality and economics of summer sorghum (*Sorghum bicolor* L.). *Intl. J. Curr. Microbiol. App. Sci*., 6(8): 1630-1636.

Sreenivas, G. and Satyanarayana, V., 1994.Nutrient removal by weeds and maize (*Zea mays* L.).*Indian J. Agron*., 41(1): 160-162.

How to cite this article:

Vinayaka, S. S., D. Krishnamurthy, A. S. Channabasavanna, Y. M. Ramesha and Manjunath Bhanuvalli. 2019. Influence of Weed Management Practices on Uptake of Nutrients by *Kharif* Sorghum [*Sorghum bicolor* (L.) Moench] and its Effect on Soil Fertility Status. *Int.J.Curr.Microbiol.App.Sci.* 8(10): 261-267. doi: https://doi.org/10.20546/ijcmas.2019.810.027