DOI: 10.15740/HAS/AU/12.TECHSEAR(2)2017/426-430
Agriculture Update
Volume **12** | TECHSEAR-2 | 2017 | 426-430
Visit us : *www.researchjournal.co.in*
e ISSN-0976-6847

RESEARCH ARTICLE :

Influence of tillage and weed management methods on nutrient uptake and yield in maize – sunflower cropping system

R. BASKARAN, R. KAVIMANI AND S. ARUNVENKATESH

ARTICLE CHRONICLE :
Received :
11.07.2017;
Accepted :
24.07.2017

SUMMARY : Field experiments were conducted during *Rabi and Kharif* season of 2012 and 2013 at northern block of Cotton Research Station, Veppantattai, to study the effect of tillage and weed management methods on weeds dynamics and yield of maize –sunflower cropping system under irrigated conditions. The experiments were laid out in strip plot design with three replications. Main plot treatment consisted of three tillage methods *viz.*, conventional tillage, minimum tillage and zero tillage. Five weed management methods *viz.*, pre- emergence application of herbicide (atrazine @ 0.5 kg ha^{-1} for maize and pendimenthalin @1.0 kg ha^{-1} for sunflower) followed by hand weeding on 40 DAS, pre- emergence application of herbicide (atrazine @ 0.5 kg ha^{-1} for maize and pendimenthalin @ 1.0 kg ha^{-1} for sunflower) followed by power weeding on 40 DAS, hand weeding twice on 20 and 40 DAS, Power weeding on 20 and 40 DAS along with an unweeded check for both the crops consisted as the sub plot treatments. The maize seeds of NK 6240 and sunflower hybrid seed sunbred were sown on 60 x 25 cm. spacing. Recommended fertilizer dose of 250:75:75 kg NPK/ha for maize and 60: 30: 30 kg NPK / ha for sunflower were applied in the form of urea, single super phosphate and murate of potash. Conventional tillage recorded higher uptake nutrients in Maize – sunflower copping system. Integrated weed management by pre-emergence application of atrazine 0.5 kg ha^{-1} for maize and pendimethalin 1.0 kg ha^{-1} for sunflower followed by a hand weeding on 40 DAS (M_1W_1) for each crop resulted in higher plant dry matter and consequently highest N, P and K nutrients uptake by the plants and leads to higher yield.

KEY WORDS :
Tillage, Weed management methods, Nutrient uptake, Yield, Cropping system

How to cite this article : Baskaran, R., Kavimani, R. and Arunvenkatesh, S. (2017).Influence of tillage and weed management methods on nutrient uptake and yield in maize – sunflower cropping system. *Agric. Update*, **12** (TECHSEAR-2) : 426-430; **DOI: 10.15740/HAS/AU/12.TECHSEAR(2)2017/426-430.**

Author for correspondence :

R. BASKARAN
Agricultural College and Research Institute, Eachangkottai, THANJAVUR (T.N.) INDIA
Email: rbaski73@gmail.com

See end of the article for authors' affiliations

BACKGROUND AND OBJECTIVES

Tillage is the mechanical manipulation of surface soil to provide a favourable environment for the germination and proper development of seeds in addition to the suppression of native weeds. Tillage affects the vertical distribution of weed seeds within the soil profile. Further, tillage can affect weeds directly, as in the destruction of annual weeds during seedbed preparation, or the effect may be more subtle, as in the shift from

large seeded broad leaved weeds to small seeded weeds in reduced tillage systems.

Manual and mechanical methods of weed control are labour intensive, costly and time consuming and often needs to be repeated at different intervals. Besides, frequent rainfall during cropping season does not permit manual and mechanical methods at the appropriate time. Thus, to eliminate weed competition from the germination stage of the crop and to reduce the yield losses, chemical control has become inevitable. Optimum doses of pre-emergence herbicides could be applied properly to reduce the weed competition at critical period of weed interference without much disturbance to crop growth and soil health. Complete control of weeds is hard to achieve by using any single method of weed control. Continuous use of herbicides over a prolonged time leads to development of resistance in weeds making them difficult to control. However, if the various components of integrated weed management are blended in a systemic way, acceptable level of weed control can be achieved.

Integrated weed management (IWM), the process of combining several single management strategies together to suppress weeds has been developed (Gill *et al*., 1997). Continuous use of herbicides over a prolonged time leads to development of resistance in weeds making them difficult to control. Hence, various components of integrated weed management are to be blended in a systematic way to achieve the acceptable level of weed control.

RESOURCES AND METHODS

Field experiment were conducted during *Rabi* and *Kharif* season of 2012 and 2013 at northern block of Cotton Research Station, Veppantattai. The soil of the experimental farm is clay loam in texture. The soil was low in nitrogen, medium in phosphorus and potassium. The experiment was laid out in strip plot design with three replications. Main plot treatment consisted of three tillage methods *viz.*, Conventional tillage, Minimum tillage and zero tillage. Five weed management methods *viz.*, pre-emergence application of atrazine@0.5 kg ha^{-1} followed by hand weeding on 40 DAS, pre- emergence application of atrazine @ 0.5 kg ha^{-1} followed by power weeding on 40 DAS, hand weeding twice on 20 and 40 DAS, power weeding on 20 and 40 DAS along with an unweeded check for both the crops consisted the sub plot treatments. The seeds of maize hybrid NK 6240 was sown on 60 x 25 cm. In conventional tillage made by one disc ploughing was given as the primary tillage operation followed by cultivator operation twice as secondary tillage. One cultivator ploughing and ridger former operation only for minimum tillage. In zero tillage sowing is the seeds were dibbled in the stubbles of the previous crop without any tillage or soil disturbance, except that which is necessary to place the seeds at the desired depth. Weed management was done as per the treatment schedule. For manual weeding treatments, two hand weeding were given on 20 and 40 DAS. Herbicide treated plots were applied with atrazine @ 0.5 kg a.i.ha^{-1} as pre-emergence spray on third day after sowing followed by a hand weeding on 40 DAS. For mechanically weeded plots, two weeding were given on 20 and 40 DAS with Garuda power weeder in between rows and within the rows weeds were removed manually.

OBSERVATIONS AND ANALYSIS

Significant variation was observed on nutrient uptake by crops as influenced both by tillage and weed management methods (Table 1 and 2). Conventional tillage (M_1) recorded the higher uptake of nitrogen (N), phosphorus (P) and potassium (K) in both the years in maize – sunflower cropping system. Quantity of nutrients uptake by crops is the reflection of crop biomass and nutrient content at each growth stage. In the present study, treatments those received conventional tillage (M_1) for maize and sunflower resulted in higher nutrient uptake by both crops. Conventional tillage facilitated better root development and lesser weed competition for long cropping period resulting in increasing nutrient uptake. Deep ploughing followed by cultivator tillage reduced the nutrient depletion by weeds and consequently increased the N,P and K uptake of wheat (Pandey *et al.*, 2001). Among the weed management methods, Integrated weed management by pre-emergence application of atrazine 0.5 kg ha^{-1} for maize and pendimethalin 1.0 kg ha^{-1} for sunflower followed by a hand weeding on 40 DAS for each crop resulted in higher plant dry matter and consequently highest N, P and K nutrients uptake by the plants. This was owing to higher dry matter production of crop and corresponding nutrient contents of the tissues in these treatments due to elimination of competition offered by weeds for nutrient up take. (Siva Sankar and Subramanyam, 2011).

Better weed control efficiency associated with

Table 1: Nutrient removal by plants as influenced by tillage and weed management practices at harvest in maize – sunflower cropping system (kg ha $^{-1}$) (2012)

Treatments	Maize			Sunflower		
	N	P	K	N	P	K
M_1	105.3	23.5	102.4	66.7	12.2	51.5
M_2	90.7	16.7	92.4	60.2	10.7	46.3
M_3	80.4	13.3	85.1	55.7	9.6	44.4
S.E.±	2.9	0.5	2.0	1.3	0.3	0.8
C.D. (P=0.05)	7.9	1.5	5.6	3.5	0.8	2.2
W_1	99.1	23.2	101.5	70.0	13.7	52.4
W_2	95.4	20.2	96.7	64.2	11.7	48.6
W_3	95.2	16.9	93.6	60.5	10.3	46.3
W_4	88.3	15.6	89.8	56.8	10.0	45.7
W_5	82.6	13.3	84.7	52.9	9.1	43.9
S.E.±	1.5	1.3	1.8	1.9	0.5	1.2
C.D. (P=0.05)	3.3	2.9	4.1	4.3	1.2	2.8
M at W						
S.E.±	4.8	1.9	3.3	3.5	0.5	2.3
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS
W at M						
S.E.±	4.5	2.1	2.9	3.5	0.7	2.3
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS

M_1-M_3- Tillage practices W_1-W_5-Weed management practices NS= Non-significant

Table 2: Nutrient removal by plants as influenced by tillage and weed management practices at harvest in maize – sunflower cropping system (kg ha $^{-1}$) (2013)

Treatments	Maize			Sunflower		
	N	P	K	N	P	K
M_1	105.4	20.3	99.6	65.3	10.7	48.8
M_2	88.5	15.1	90.0	58.5	9.2	44.6
M_3	77.9	11.7	82.5	54.7	8.7	42.3
S.E.±	2.3	0.5	2.6	3.1	0.3	1.3
C.D. (P=0.05)	5.2	1.5	5.8	6.6	0.8	3.7
W_1	98.2	20.2	98.6	69.6	11.6	51.6
W_2	95.1	16.5	93.4	62.8	9.9	46.2
W_3	89.7	15.9	92.7	59.5	9.3	44.1
W_4	89.2	14.1	86.6	55.1	8.8	42.9
W_5	80.7	11.9	82.1	50.6	8.0	41.4
S.E.±	2.8	1.2	2.0	2.4	0.5	1.4
C.D. (P=0.05)	6.5	2.8	4.6	5.5	1.2	3.2
M at W						
S.E.±	4.68	1.91	3.3	4.8	0.6	3.1
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS
W at M						
S.E.±	5.04	2.09	3.5	4.3	0.7	2.9
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS

M_1-M_3- Tillage practices W_1-W_5-Weed management practices NS= Non-significant

Table 3 : Effect of tillage and weed management practices on yield of maize -sunflower cropping system (2012)

Treatments	Maize								Sunflower			
	Grain yield (kg ha^{-1})				Stover yield (kg ha^{-1})				Seed yield (kg ha^{-1})			
	M_1	M_2	M_3	Mean	M_1	M_2	M_3	Mean	M_1	M_2	M_3	Mean
W_1	6800	6260	5794	6390	9953	9178	8580	9204	1793	1685	1443	1640
W_2	6403	5913	5580	5965	9129	8670	8108	8602	1690	1585	1358	1544
W_3	6192	5755	5158	5702	8953	8415	7865	8378	1645	1499	1223	1456
W_4	6082	5607	4947	5545	8435	8170	7550	8018	1524	1408	1212	1381
W_5	4493	3852	3765	4037	8209	7870	7240	7740	1452	1343	1184	1326
Mean	5981	5467	5041		8936	8461	7869		1621	1504	1284	
S.E.±	M	W	M at W	W at M	M	W	M at W	W at M	M	W	M at W	W at M
	176.	161.	100	178	210.	228	173	234	39	37	43	40
C.D. (P=0.05)	404.	350.	240.	412	462	503	410	510	109	86.	110	94

M_1-M_3- Tillage practices W_1-W_5-Weed management practices

Table 4 : Effect of tillage and weed management practices on yield of maize -sunflower cropping system (2013)

Treatments	Maize								Sunflower			
	Grain yield (kg ha^{-1})				Stover yield (kg ha^{-1})				Seed yield (kg ha^{-1})			
	M_1	M_2	M_3	Mean	M_1	M_2	M_3	Mean	M_1	M_2	M_3	Mean
W_1	5667	5396	5016	5360	9100	8548	8340	8763	1736	1591	1352	1560
W_2	5400	5094	4784	5082	8800	8061	7889	8283	1576	1497	1272	1448
W_3	5160	4962	4465	4863	8340	7800	7650	8033	1522	1412	1209	1381
W_4	5069	4839	4289	4732	7841	7667	7186	7631	1435	1318	1136	1296
W_5	3744	3377	3221	3447	7450	7200	6958	7286	1364	1264	1090	1239
Mean	5008	4723	4351		8306	7855	7605		1527	1417	1212	
S.E.±	M	W	M at W	W at M	M	W	M at W	W at M	M	W	M at W	W at M
	116	120	115	120	206	203	189	180	39	45	42	37
C.D. (P=0.05)	256	264	250	268	446	440	410	390	107	98	107	85

M_1-M_3- Tillage practices W_1-W_5-Weed management practices

herbicidal + manual weeding in both the crops might have favoured vigorous growth of plants, higher plant dry matter with uptake of more amounts of nutrients by maize and sunflower crops, may be due to maximum utilization of resources by weeds rather than crops, as a result of high degree of weed competition. Similar results were earlier reported by Girijesh and Patil (1989). Obviously, unweeded control (W_5) in both the crops resulted in lesser plant dry matter in turn recording the least nutrient uptake by both the sunflower and maize plants, which might be due to maximum utilization of resources by weeds. Similar results were reported earlier by Veeramani *et al*. (2000).

Malipatil and Patil (1990) who stated that, in the absence of higher weed competition, sunflower made the fullest use of nutrients and hence nutrient uptake by the crop was maximum in the herbicide + manual weeding methods. Better weed control efficiency associated with herbicidal application and hand weeding favoured vigorous growth of plants, higher plant dry matter with uptake of more amounts of nutrients (*Chander et al.*, 1994).

Integrated weed management by pre-emergence application of atrazine 0.5 kg ha^{-1} for maize and pendimethalin 1.0 kg ha^{-1} for sunflower followed by a Hand weeding on 40 DAS for each crop resulted in higher uptake of nutrients. This is mainly attributed to efficient control of weeds in early stage and later by mechanical treatments which reduced the weed density and dry matter accumulation by weeds and ultimately led to lower uptake of nutrients by weeds and on the contrary led to higher uptake of nutrients by maize. Hence, the crop growth was better and it utilized maximum amount of major nutrients. Similar results were earlier reported by Hassan and Ahmed (2005) who stated that weed eradication made more water and nutrients available for maize growth, which was reflected in the enhanced growth and thus, yield.

Authors' affiliations :

R. KAVIMANI, Institute of Agriculture, Agricultural Engineering College and Research Institute, KUMULUR (T.N.) INDIA

S. ARUNVENKATESH, Agricultural College and Research Institute, Eachangkottai, THANJAVUR (T.N.) INDIA

REFERENCES

Chander, S. S., Katyal, K. and Panwar, B.S. (1994). Nutrient uptake by American cotton and weeds under different fertility levels and methods of weed control. *Haryana J. Agron.*, **10** (2): 237-239.

Gill, M.K., Gaur, B.L. and Rao, D.S. (1997). Comparative efficacy of pre-and post emergence herbicides in controlling weeds in rainy-season maize (*Zea mays*). *Indian J. Agron.*, **36** : 261-262.

Girijesh, G.K. and Patil, V.C. (1989). Effect of weed control in groundnut and sunflower intercropping system with reference to nutrient uptake and oil yield. *J. Oilseeds Res.*, **6** : 334-340.

Hassan, A.A.A. and Ahmed, M.K.A. (2005). The influence of some herbicides and additional hoeing in maize growth and yield and yield components. *Intl J. Agric. Bio.*, **7** (5) : 708-711.

Malipatil, T. B. and Patil, V.C. (1990). Nutrient uptake by weeds and sunflower. *Haryana J. Agron.*, **2** : 167-168.

Pandey, I.B., Sharma, S.L., Tiwari, S. and Bharati, V. (2001). Effect of tillage and weed management on grain yield and nutrients removal by wheat (*Triticum aestivum*) and weeds. *Indian J. Weed Sci.*, **33** (3/4): 107-111.

Siva Sankar, K. and Subramanyam, D. (2011). Weed flora and yield of sunflower (*Helianthus annuus*) as influenced by pre and post emergence application of herbicides. *Indian J. Weed Sci.*, **43** (1&2) : 105-109.

Veeramani, A., Palchamy, A., Ramasamy, S. and Rangaraju, G. (2000). Integrated weed management in soybean (*Glysine max*) under different moisture regimes and population densities. *Indian J. Agron.*, **45** (1) : 740-745.