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Short communication

Weed management to improve productivity and nutrient uptake of *Rabi* maize

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In Indian agriculture, maize assumes a special significance on account of its utilization as food, feed and fodder besides several industrial uses. There are many socio-economic, physical and biological factors limiting the productivity of maize crop. Among the biotic production constraints, weeds play important role. Nature of weed problem in *Rabi* maize is quite different from that of the rainy season maize. Heavy application of fertilizers coupled with frequent irrigation favours the profuse growth of weeds in maize which compete with the crop for soil moisture, nutrients and space during the initial slow growth resulting in decline in productivity. Yield reduction from 33-90% has been reported in *Rabi* maize (Dalley *et al*. 2006). Approximately 65 - 80% of the plant total N is taken up by maize before silking, (Rajcan and Tollenaar 1999). After silking, less assimilates are supplied to roots as the kernels become the major sink for photo assimilates. In weedy check treatment, 14% reduction in yield was noticed when compared to weed free condition. Weed control can increase fertilizer use efficiency of the crop with checking wasteful removal of nutrients by weeds (Samant *et al*. 2015). Keeping this in view, present investigation was undertaken to study weed growth, yield and nutrient uptake in maize under varied sustainable weed management practice during winter season under irrigated conditions.

Experiment was conducted during *Rabi*, 2014-15 at College farm, Rajendranagar, Hyderabad, with eight sustainable weed management practices in randomized block design, replicated thrice (**Table 1**). Plant samples of crop and weeds were collected at the time of harvest from each plot. These were oven dried, ground into powder and chemically analyzed for N, P and K content as per recommended procedure as suggested by Subbiah and Asija (1956) for N, Olsen *et al*. (1954) for P and Jackson (1973) for K. The nitrogen, phosphorus and potassium uptake by crop and weeds was calculated by multiplying per cent content in the tissue with their respective dry matter values and expressed as kg/ha.

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Weed flora

The floristic composition of the experimental site at physiological maturity stage was dominated by *Trianthema. portulacastrum, Trichodesma indicum, Parthenium hysterophorus, Melilotus alba, Digera arvensis, Dactyloctenium aegyptium, Cyperus rotundus, Cynodon dactylon, Commelina benghalensis Chenopodium album, Amaranthus polygamus* and *Eragrostis cilianensis.*

Effect on dry matter and yield

Reduced weed dry matter was noticed significantly in farmers practice (HW at 20 and 40 DAS), which was comparable with black and white polythene mulch (25 µm thickness UV resistant). Weed management practices brought about significant effect on crop dry matter (**Table 1**). Application of black polythene mulch showed significant increase in crop dry matter at physiological maturity stage. This was not differed significantly with white polythene mulch, farmers practice (HW at 20 and 40 DAS) and pre-emergence (PE) application of atrazine 1.0 kg/ha *fb* 2,4-D sodium salt 1.0 kg/ha at 30 DAS treatment. In polythene mulch treatment, weeds seeds might have failed to germinate due to lack of light and rise in temperature and also due to increase in minimum temperature required for normal growth and vigorous growth of the maize plants as reflected in plant height which caused an early crop canopy development and ultimately helped in smothering the weed flora. The higher dry matter in polythene mulch might be due to reflection of PAR into plant canopy, increased photosynthesis and biomass accumulation (Loy *et al*. 1998).

Nutrient uptake was found higher in treatments which produced higher biomass. Irrespective of the treatments, highest N, P and K removal was noticed with black polythene mulch, which was at par with white polythene mulch and farmers practice for grain nitrogen, whereas for grain P and K, higher removal was observed with black polythene mulch and was comparable with white polythene mulch and were followed by farmers practice and pre-emergence application of atrazin 1 kg/ha *fb* 2,4-D sodium salt 1.0 kg/ha at 30 DAS (**Table 2**). Increased stover NPK uptake was recorded with black and white polythene mulch and was at par with stover N uptake of farmers practice, stover P uptake of farmers practice and pre-emergence application of atrazine 1.0 kg/ha *fb* 2,4-D sodium salt 1.0 kg/ha at 30 DAS treatment. But, K stover uptake in mulch treatments was significantly superior over rest of the treatments. The higher removal of these nutrients by black and white polythene mulch was due to vigorous growth with adequate supply of these nutrients resulting in higher biological yield coupled with their effective transfer to the ultimate sink *i.e*. grains thus leading to numerically higher *Rabi* maize grain nutrient contents of N, P and K (Kaur *et al*. 2014). Among weed management practices, highest N, P and K removal from grain and stover of *Rabi* maize was observed from farmers practice (hand weeding twice at 20 and 40 DAS) and pre-emergence application of atrazine 1.0 kg/ha *fb* 2, 4- D sodium salt 1.0 kg/ha at 30 DAS. This could be attributed to higher weed control efficiency resulting in more favourable environment for growth and development of crop apparently due to the lesser weed competition. The results were in conformity with findings of Kour *et al*. (2014) in winter maize.

At harvest, higher NPK uptake of whole plant was recorded with black and white polythene mulch and was not differed significantly with N uptake and was comparable with farmers practice (hand weeding twice at 20 and 40 DAS). Even though whole plant P uptake was significantly superior in mulch treatments over other treatments, but it was at par with K nutrient uptake observed with farmers practice (hand weeding twice at 20 and 40 DAS) and pre-emergence application of atrazine 1.0 kg/ha *fb* 2,4-D sodium salt 1.0 kg/ha at 30 DAS (**Table 3**). This was due to efficient control of the complex weed flora due to which nutrient availability for crop increased, which helped to increase in higher dry matter accumulation in crops. The lowest nutrient uptake was recorded with weedy check. Results conformed the findings of Shrinivas *et al*. (2014).In farmers practice and other sustainable weed

Table 1. Effect of weed management on weed dry matter of crop and weeds grain yield of maize during *Rabi* 2014-15

Treatment	Weed dry matter (g/m)	Crop dry matter (g/plant)	Grain yield (t/ha)
Farmers practice (HW at 20 and 40 DAS)	4.86 (22.67)	451	7.07
Atrazine 1.0 kg/ha as PE *fb* 2, 4- D sodium salt 1.0 kg/ha at 30 DAS	9.71 (93.33)	445	6.91
Live mulch (vegetable cowpea)	6.55 (42.00)	250	4.26
Brown manuring (desiccation of cowpea live mulch at 50% flowering with 2, 4-D sodium salt 1.0 kg/ha)	6.80 (45.67)	327	3.86
Black polythene mulch (25 µm thickness UV resistant)	5.80 (32.67)	489	7.66
White polythene mulch (25 µm thickness UV resistant)	6.08 (36.00)	466	7.56
High density planting (planting on either side of the ridge) + halosulfuron methyl 67.5 g/ha at 20 DAS	7.02(53.00)	271	5.34
Weedy check (no weed control)	10.45(108.33)	232	3.85
LSD (p=0.05)	1.69	45.13	0.77

Figure in parentheses are original values transformed to $\sqrt{x+0.5}$; PE - Pre-emergence

Table 2. Effect of weed management on nutrient uptake by grain and stover of maize during *Rabi* 2014-15

Treatment	N (kg/ha)		P_2O_5 (kg/ha)		K_2O (kg/ha)	
	Grain	Stover	Grain	Stover	Grain	Stover
Farmers practice (HW at 20 and 40 DAS)	71	61	23	14	31	84
Atrazine 1.0 kg/ha as PE *fb* 2,4-D sodium salt 1.0 kg/ha at 30 DAS	68	47	22	13	27	79
Live mulch (vegetable cowpea)	44	40	14	11	16	70
Brown manuring (desiccation of cowpea live mulch at 50% flowering with 2,4-D sodium salt 1.0 kg/ha)	39	49	13	10	14	68
Black polythene mulch (25 µm thickness UV resistant)	79	58	28	14	34	99
White polythene mulch (25 µm thickness UV resistant)	79	58	28	14	33	95
High density planting (planting on either side of the ridge) and application of halosulfuron methyl 67.5 g/ha at 20 DAS	47	49	17	10	19	63
Weedy check (no weed control)	37	41	12	10	15	65
LSD (p=0.05)	3.52	3.43	1.34	0.78	1.15	4.19

Table 3. Effect of weed management practices on total nutrient uptake by crop and weeds at harvest in maize during *Rabi* 2014 15

Treatment	Crop (kg/ha)			Weeds (kg/ha)		
	N	P_2O5	K_2O	N	P_2O5	K_2O
Farmers practice (HW at 20 and 40 DAS)	132	37	115	3	0	4
Atrazine 1.0 kg/ha as PE *fb* 2,4-D sodium salt 1.0 kg/ha at 30 DAS	115	35	106	13	2	15
Live mulch (vegetable cowpea)	84	25	86	6	1	6
Brown manuring (desiccation of cowpea live mulch at 50% flowering with 2, 4-D sodium salt 1.0 kg/ha)	87	23	83	6	1	7
Black polythene mulch (25 µm thickness UV resistant)	137	41	133	5	1	6
White polythene mulch (25 µm thickness UV resistant)	137	42	129	5	1	6
High density planting (planting on either side of the ridge) and application of halosulfuron methyl 67.5 g/ha at 20 DAS	96	27	82	6	1	6
Weedy check (no weed control)	78	21	81	16	2	17
LSD (p=0.05)	16.73	4.81	12.64	0.92	0.19	1.14

management practices, weeds showed minimum nutrient depletion compared to pre-emergence application of atrazine 1.0 kg/ha and weedy check owing to function of concentration of nutrients and total weed biomass (Sinha *et al.* 2005).

Significantly more grain yield obtained under black polythene mulch, which was comparable with grain yield of white polythene mulch, farmers practice (HW at 20 and 40 DAS) and pre-emergence application of atrazine 1.0 kg/ha *fb* 2, 4- D sodium salt 1.0 kg/ha at 30 DAS. (**Table 1**). According to Tollenaar and Lee (2006) increase in maize grain yield under polythene mulches was mainly attributed to an increase in biomass production, especially during the reproductive stage. Thus it can be summerised that, sustainable weed management practices of application of either black or white polythene mulch of 25 µm thickness UV resistant is effective to get season long weed control with reduced weed drymatter and increased productivity in *Rabi* maize

SUMMARY

Present investigation was undertaken to study weed growth, yield and nutrient uptake in maize under varied weed management practice during winter season under irrigated conditions. Reduced weed dry matter was noticed significantly in farmers practice (HW at 20 and 40 DAS), which was comparable with black and white polythene mulch (25 µm thickness UV resistant). Application of black polythene mulch showed significant increase in crop dry matter at physiological maturity stage. highest N, P and K removal was noticed with black polythene mulch and was at par with white polythene mulch and farmers practice for grain nitrogen, whereas for grain P and K, higher removal was observed with black polythene mulch. Significantly more grain yield was obtained under black polythene mulch, which was comparable with grain yield of white polythene mulch, farmers practice (HW at 20 and 40 DAS) and pre-emergence application of atrazine 1.0 kg/ha *fb* 2, 4- D sodium salt 1.0 kg/ha at 30 DAS.

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