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Short communication

Effect of brown manuring on weed growth, yield and economics of irrigated maize

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Maize (*Zea mays* L.) considered as the queen of the cereals, is one of the most important crops next to rice and wheat in global agriculture. Though maize is under cultivation in India, production and productivity are comparatively less over temperate countries. It was due to many factors. However, the factor which causes drastic reduction in growth, development and yield of the maize is weed which accounts for 40% yield loss and even >70% yield loss under uncontrolled weed growth condition in maize. Weeds are controlled by many means. However, in the current scenario of agriculture, evolving ecofreindly approach of weed control is more advisable so as to protect the natural resources such as soil flora and fuana including human being and animals in a holistic manner.

In this context, an advanced weed management strategy which has emerged in India is brown manuring. It aimed at suppressing the weeds without affecting the soil physico and chemical properties and its associated microbes. It can be achieved through raising green manure crops such as *Sesbania* (Daincha), sunhemp *etc*. as inter crop and killing the same by application of post-emergence herbicides. The killed manure is allowed to remain in the field along with main crop without incorporation / in-situ ploughing until its residue decomposes itself in the soil aiming to add organic manure beside weed suppression by its shade effect. Given the post-emergence spray on green manure leaves resulting in loss of chlorophyll in leaves showing brown in colour is referred to as brown manuring (Tanwar *et al.* 2010). Brown manuring also helps in suppressing the weeds upto 50% of total weed population on the account of the shade effect of killed green manure till 45 DAS upto which the critical period of crop weed competition continues in maize. Keeping these points in view, a study was undertaken to find out the effect of brown manuring on weed growth, yield and economics of irrigated maize.

A field experiment was conducted during late *Rabi* season of 2011-2012 at Agricultural College and Research Institute, Madurai. The experiment was laid out in randomized block design with seven treatments and replicated thrice (Table1). The maize hybrid *'CoH (M) 5'* was sown with recommended space of 60 x 25 cm. In between the rows of maize, two rows of *Sesbania* were sown with an intra row spacing of 20 cm in the respective treatments as per treatment schedule. The sowing of maize and daincha was taken up simultaneously.

Calibrated quantity of herbicides was applied as aquous spray (500 l/ha) with knapsack sprayer. Hoeing was given on 20 and 35 DAS in mechanical weeding by hand hoeing twice. Pre-emergence application of alachlor was given 1.0 kg/ha on 3rd DAS in the respective treatments. In brown manuring treatments plots, *Sesbania* (daincha) and maize were grown together for 35 days and thereafter, *Sesbania* was knocked down with the use of 2,4-D spray 0.5 kg/ha.

Results revealed that density of grasses, sedges, broad-leaved weeds and total weeds was reduced substantially by pre-emergence alachlor 1.0 kg/ha + brown manuring over rest of the treatments at 60 DAS (Table1). This might be due to pre-emergence alachlor application which provided effective control of weeds during the early stage and maintained nearly weed free conditions upto 30 DAS and suppression of weeds thereafter by the shade effect of daincha crop residue and rapidly growing canopy of maize at later stages up to harvest. However, it was equally effective as that of PE alachlor 1.0 kg/ha + daincha as inter crop with in-situ incorporation on 35 DAS. This result corroborated with the findings of Samar Singh *et al.* (2007). Among the treatments, the weed density was statistically higher in unweeded check. It was due to rank weed growth under uncontrolled situations during the entire crop growth period.

With regard to weed control efficiency, it was higher (89.65% at 60 DAS) in PE alachlor 1.0 kg/ha + brown manuring (Table 1). This was closely followed by PE alachlor 1.0 kg/ha + daincha as intercrop with in-situ incorporation on 35 DAS (86.04% of at 60 DAS). This

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was evident from greater reduction weed density in this treatment. This was in agreement with the findings of Kumar and Mukherjee (2011).

The higher stature of yield attributes, *viz.* cob length (17.09 cm), no. of grains/cob **(**569.14) and 100 grain weight (23.57 g) were noticed with PE alachlor 1.0 kg/ha + brown manuring. The improvement in the yield attributes in the above said treatment was primarily due to less weed competition during the crop weed competition period as a result of better weed control by pre-emergence alachlor up to 30 DAS and suppression of weeds thereafter by smothering effect of brown manuring till harvest. PE alachlor 1.0 kg/ha + dainaha as intercrop with in-situ incorporation on 35 DAS has also increased the value of yield attributes next to the above promising treatment (Table 1). The yield attributes were greatly affected by rank weed growth recorded in unweeded check.

The highest grain (7.23 t/ha) and stover yield (11.56 t/ha) was recorded with PE alachlor 1.0 kg/ha + brown manuring (Table 1). It was closely followed by PE alachlor 1.0 kg/ha + daincha as intercrop with in-situ incorporation on 35 DAS (6.38 and 10.20 t/ha). These results are in conformity with the findings of Kumar and Mukherjee (2011). Infestation of more weeds noticed in unweeded check resulted in drastic reduction in grain and stover yield as compared to the rest of the treatments.

Maximum productivity of grain and stover yield with PE alahclor 1.0 kg/ha + brown manuring had resulted in the highest net return of ₹ 45,993/ha and benefit cost ratio of 3.061 during the year of the study (Table 1). This might be due to higher economic yield recorded in this treatment. This result was in conformity with the findings of Sunitha *et al.* (2010). PE alachlor 1.0 kg/ha + daincha as intercrop with in-situ incorporation on 35 DAS was the next best practice in increasing the net returns (₹ 37,235/ha) and benefit cost ratio (2.97). Weeds allowed to grow during the crop season in unweeded check deprived the crop for all the available growth resources and resulted in poor performance of maize and reduced the grain and stover yield and finally economic returns. Similar results were also reported by Pandey *et al.* (2002).

Table 1. Effect of brown manuring on weed density, yield and economics of maize

Treatment	Density of weeds at 60 DAS				Weed contrsol efficiency (%)	Yield attributes			Grain yield (t/ha)	Stover yield (t/ha)	Net returns (x10^3 ₹/ha)	B:C ratio
	Grasses	Sedges	Broad-leaved weeds	Total (no./m^2)		Cob length (cm)	No. of grains /cob	100-grain weight (g)				
Mechanical weeding by hand hoe on 20 and 35 DAS	7.50 (0.97)	6.66 (0.93)	5.66 (0.88)	19.82 (1.33)	80.5	14.5	433.1	21.3	5.67	8.51	29.23	2.43
PE alachlor 1.0 kg/ha *fb* mechanical weeding at 35 DAS	7.16 (0.96)	6.16 (0.91)	5.49 (0.87)	18.48 (1.31)	81.5	14.6	434.6	21.3	5.75	8.63	31.64	2.70
Daincha as intercrop with in-situ incorporation on 35 DAS	9.66 (1.06)	8.00 (1.00)	8.00 (1.00)	25.66 (1.44)	74.8	13.1	372.9	20.7	4.56	6.85	21.43	2.16
Brown manuring	9.26 (1.05)	7.66 (0.98)	7.66 (0.98)	24.15 (1.41)	75.8	13.2	375.0	20.8	4.61	6.92	23.33	2.37
PE alachlor 1.0 kg/ha + daincha as intercrop with in-situ incorporation on 35 DAS	5.66 (0.88)	4.33 (0.80)	4.20 (0.79)	14.19 (1.20)	86.0	15.9	489.7	22.4	6.38	10.20	37.23	2.97
PE alachlor 1.0 kg/ha + brown manuring	4.16 (0.78)	3.20 (0.71)	3.16 (0.71)	10.52 (1.09)	89.7	17.1	569.1	23.6	7.23	11.56	45.99	3.61
Unweeded check	32.83 (1.54)	32.16 (1.53)	36.66 (1.58)	101.65 (2.01)	-	11.2	275.1	17.2	3.19	4.80	11.57	1.71
LSD (P=0.05)	0.031	0.058	0.062	0.054	-	0.86	6.46	0.72	0.31	0.31	-	-

Figures in parentheses are log (x+2) transformed values

Sale price of output (₹ 0./t): Maize grain - 8000, maize stover - 500, Input price (₹ /kg): Maize seed - 190, Seed of daincha - 40, Urea - 4.78, SSP-3.22, Mop-4.45; Herbicides (₹ /l): Alachlor - 325, 2, 4-D sodium salt - 300; Labour wage - ₹ 125/man day for A type, ₹ 100/man day for B type

SUMMARY

A field experiment was conducted during *Rabi* season of 2011-12 at Madurai to study the effect of brown manuring on weed dynamics, yield and yield attributes and economics of irrigated maize. The weed management practice of PE alachlor 1.0 kg/ha + brown manuring proved to be effective in registering the lowest weed density of grasses, sedges, broad-leaved weeds and total weeds at 20, 40 and 60 days after sowing (DAS) and was at par with PE alachclor 1.0 kg/ha + daincha as intercrop with in-situ incorporation on 35 DAS except at 20 and 40 DAS. The above said prominent treatment has also registered higher weed control efficiency (84.41, 92.15 and 89.65% at 20, 40 and 60 DAS, respectively). As a result, the above promising treatment has increased the yield attributes such as cob length (17.09 cm), no. of rows/cob (14.76), no. of grains/row (38.56) and 100-grain weight (23.57 g), which in turn reflected in registering higher grain yield of 7,227 kg/ha and stover yield of 11,563 kg/ha. The net returns (₹ 45,993/ha) and benefit cost ratio (3.61) were also more in PE alachlor 1.0 kg/ha + Brown manuring. The weed management practice of PE alachlor 1.0 kg/ha + daincha as intercrop with in-situ incorporation on 35 DAS was found to be the next best treatment in recording the higher grain and stover yield and economic returns. Uncontrolled weed growth throughout the crop growth period in unweeded check reduced the grain and stover yield to the extent of 44.2% and 41.5%, respectively as compared to PE alachlor 1.0 kg/ha + brown manuring.

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