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Nutrient removal by weeds and organic Brinjal (*Solanum melongena* L.) Through weed management interventions

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Abstract
The aim of the investigation was to study the impact of corn flour application on nutrient uptake of organic brinjal and nutrient removal by weeds. The treatments comprised of different non chemical weed management practices *viz.*, Live mulching with sunnhemp after 30 days of growth (T_1); Application of Corn Flour @ 1 ton ha^{-1} on 3 DAT (T_2); Application of Corn Flour @ 1 ton ha^{-1} on 3 DAT + HW at 60 DAT (T_3); Live mulching with Multi Varietal crops (Navathaniam) after 30 days of growth (T_4); Application of sunflower dried stalk extract on w/v basis @ 1:10 lit ha^{-1} on 3 DAT (T_5); Application of sunflower dried stalk extract on w/v basis @ 1:10 lit ha^{-1} on 3 DAT + HW at 60 DAT (T_6); Mechanical weeding twice using twin hoe weeder on 30 and 60 DAT (T_7); Hand Weeding on 30 and 60 DAT (T_8); Weed free check (T_9); and Unweeded control (T_{10}). Results indicated higher nutrient uptake (81.0, 11.7 and 47.4 kg N, P_2O_5 and K_2O ha^{-1}) in crops in the treatment which was subjected to Application of Corn Flour @ 1 ton ha^{-1} on 3 DAT + HW at 60 DAT. Application of sunflower dried stalk extract on w/v basis @ 1:10 lit ha^{-1} on 3 DAT + HW at 60 DAT (73.2, 10.7 and 43.5 kg N, P_2O_5 and K_2O ha^{-1}) was next best treatment. Positive response of crop yield to nutrient uptake and negative response to weed nutrient drain was observed.

Keyword: corn flour, organic brinjal, weed removal, crop nutrient uptake

1. Introduction

Weed tends to compete with the crop for the available nutrients thereby suppressing the crop. On account of the early establishment and faster growth characteristic, weeds tend to have an upper hand on crop. Nutrient drain by virtue of weeds in the crop production especially in the organic system is very critical leading to drastic reduction in the crop yield. Among the various kinds of pests, the yield reduction in brinjal due to weed alone range from 49 to 90 per cent (Reddy *et al.*, 2000) [8]. Management of the weeds in brinjal would result in considerable saving of the nutrients. Weeds observed in organic fields are similar to conventional fields but with greater species diversity (Frick, 2005; Roschewitz, *et al.* 2005) [3, 7]. Composition of the weed flora with respective nutrient concentration in tissue is also an important factor in quantity of nutrient drain by the weeds. Organic agriculture produce are valued export products and are in demand locally. Brinjal is a valued versatile vegetable crop for its richness in phosphorus, carotene and vitamin C, as well as possessing some medicinal properties. Brinjal occupies an area of 10,310 hectares and production of 1.14 MT with productivity of 11.129 MT (2014-15). However, the organic brinjal cultivation occupies less area of 728 ha in India whereas in Tamil Nadu it is about 168 ha (Anon., 2016) [1]. Weed competition is termed as one of main deterrent in contained organic brinjal yield. Hence effective non chemical weed management needs to given special attention with regard to increasing the brinjal production under organic scenario. Stale seedbed technique, crop rotation, use of green manures and cover crops, forages, mulches, intercropping, use of highly competitive crops, crop cultivars, use of the allelopathic crops and other physical methods are commonly followed weed management practices in organic system (Bond and Grundy, 2001) [2]. Despite the serious threat weeds offer to organic crop production relatively little attention has so far be paid in research on weed management in organic weed management in general and vegetables in particular (Oruonye and Okrikata, 2010) [10]. Hence an attempt was made to study the effect of different non chemical weed management practices on nutrient uptake in organic brinjal and weed.

2. Materials and Methods

The experiment was conducted at Annur, Coimbatore district, Tamil Nadu. During *kharif* 2015. Soil of the experimental site was clay loam, neutral pH (7.8),high in organic C (1.10 %) and low in available nitrogen (168.2 kg/ha), high in available phosphorus (28.4 kg/ha) and high in available potassium (523.5 kg/ha).Experiment was laid out in randomized block design comprising 10 treatments with three replications. The treatments comprised of different non chemical weed management practices *viz.*, Live mulching with sunnhemp after 30 days of growth (T_1); Application of Corn Flour @ 1 ton ha^{-1} on 3 DAT (T_2); Application of Corn Flour @ 1 ton ha^{-1} on 3 DAT + HW at 60 DAT (T_3); Live mulching with Multi Varietal crops (Navathaniam) after 30 days of growth (T_4); Application of sunflower dried stalk extract on w/v basis @ 1:10 lit ha^{-1} on 3 DAT (T_5); Application of sunflower dried stalk extract on w/v basis @ 1:10 lit ha^{-1} on 3 DAT + HW at 60 DAT (T_6); Mechanical weeding twice using twin hoe weeder on 30 and 60 DAT (T_7); Hand Weeding on 30 and 60 DAT (T_8); Weed free check (T_9); and Unweeded control (T_{10}). Organic source of well decomposed FYM, vermicompost, panchagavya and jeevamurth were used as nutrient source. FYM to meet the recommended dose of nutrients was applied before the sowing operation in the experimental site. Nutrient uptake by crop and weed at harvest was analyzed. Standard procedure as described by Humphries (1956) [5] for estimation of the plant nitrogen, Jackson (1973) [6] for estimation phosphorus and potassium were employed. Statistical analysis was carried out based on the procedure given by Gomez and Gomez (1984) [4].

3. Results and Discussion

Weed flora composition

Weed composition of the experimental site was predominant by the BLW>Sedges. The weed flora comprised of one sedge and four species of broad leaved weeds. Analysis of relative density of the individual weed species revealed that the weed flora of the experimental field was dominated by broad leaved weeds (70.64 per cent) comprising of *Euphorbia geniculata*, *Trianthema portulacastrum*, *Boerhaavia diffusa* and *Commelina bengalensis* The only sedge *Cyperus rotundus* L. recorded 29.36 per cent of total weed flora.

Nutrient uptake by crop and weeds

Nutrient depletion from the soils is function of dry weight and nutrient concentration in crop and weeds. Weed free treatment recorded significantly higher nutrient uptake in organic brinjal (60.9, 36.5 and 138.9 kg N, P_2O_5 and K_2O ha^{-1}). Among the weed treatments, Application of Corn Flour @ 1 ton ha^{-1} on 3 DAT + HW at 60 DAT accounted for higher uptake of nutrients (58.5, 34.4 and120.0 kg N, P_2O_5 and K_2O ha^{-1}) in organic brinjal which was on par with Application of sunflower dried stalk extract on w/v basis @ 1:10 lit ha^{-1} on 3 DAT + HW at 60 DAT (55.2, 31.9 and 114.2 kg N, P_2O_5 and K_2O ha^{-1}). (Table 1 and *Fig*. 1). Whereas, unweeded control accounted for lowest nutrient uptake in organic brinjal (26.4, 15.1 and 62.3 kg N, P_2O_5 and K_2O ha^{-1}). Higher NPK uptake in organic brinjal might be construed to effective management of weeds which might had facilitated for maximum utilization of resources by crop. Corresponding lower uptake of NPK by weed was observed in best weed managed treatment might be attributed to resultant lower weed dry weight. Results are in confirmation with the findings of Christians *et al.* (1993) [9]. Ineffective weed treatments accounted for higher nutrients in weeds (Table 1and *Fig* 2). Unweeded control accounted for significantly higher NPK in weeds on account of profound competition with organic brinjal (90.50, 22.70 and 62.70 kg N, P_2O_5 and K_2O ha^{-1}) followed by Live mulching with Multi Varietal Crops (Navathaniyam) (11.50, 5.30 and 15.01 kg N, P_2O_5 and K_2O ha^{-1}). Weeds usually grow faster than crop plants and thus absorb the available nutrients quickly resulting in inadequate supply of the nutrients to the crops as result of ineffective management of the weeds.

Yield response to nutrient uptake

Highest seed yield was recorded in the weed free treatment (338 q/ha). Among the non chemical weed management treatments, Application of Corn Flour @ 1 ton ha^{-1} on 3 DAT + HW at 60 DAT (329 q/ha) resulted in significantly higher fruit yield of organic brinjal which was on par with Application of sunflower dried stalk extract on w/v basis @ 1:10 lit ha^{-1} on 3 DAT + HW at 60 DAT (284 q/ha). Whereas corresponding lower seed yield was recorded in weedy check (117 q/ha) followed by Live mulching with Multi Varietal Crops (Navathaniyam) (180 q/ha). Observations on nutrient uptake, weed nutrient drain and crop yield indicate negative relation between the nutrient uptake by weeds and seed yield whereas, yield of organic brinjal showed positive relation with the nutrient uptake by the crop. Results are in conformity with the findings of Webber *et al.* (2007) [11] in organic brinjal. Higher nutrient uptake in the crop was in response to effective weed management and concomitant reduced weed nutrient drain and concomitant higher nutrient uptake by organic brinjal. Non chemical weed management practices followed to remove the weed competition at the critical crop weed competition period resulted in effective weed control. Application of corn flour @ 1 t/ha followed by one hand weeding proved effective over the other non chemical weed control methods evaluated in reducing the weed nutrient drain with corresponding increase in crop nutrient uptake and yield.

4. Conclusion

The present study indicated that application of Corn Flour @ 1 ton ha^{-1} on 3 DAT + HW at 60 DAT resulted in higher nutrient uptake of organic brinjal since corn flour contains 10% Nitrogen and 1% Phosphorus by weight. The weed nutrient removal was significantly lower in Corn flour applied plots and this was on par with application of sunflower dried stalk extract on w/v basis @ 1:10 lit ha^{-1} on 3 DAT + HW at 60 DAT. Hence application of corn flour @ 1 ton ha^{-1} will be a viable option for effective weed control and increases nutrient uptake of organic brinjal which leads to increased fruit yield.

Table 1: Effect of non-chemical weed management practices on nutrient uptake by crop and nutrient removal by weeds in organic brinjal

Treatments		N	P (kg/ha) Crop uptake	K	N	P (kg/ha) Weeds removal	K	Fruit Yield (q/ha)
T_1	- Live mulching with Sunnhemp	40.8	23.1	94.5	10.30	5.10	14.60	200
T_2	- PE application of Corn flour@ 1 t/ha	42.6	24.6	95.4	9.90	3.01	6.10	258
T_3	- PE application of Corn flour@ 1 t/ha *fb* HW at 60 DAT	58.5	34.4	120.0	3.41	1.20	2.87	329
T_4	- Live mulching with Multi Varietal Crops (Navathaniyam)	37.3	22.9	94.2	11.50	5.30	15.01	180
T_5	- PE application of dried sunflower stalk solution on w/v basis @ 1:10 lit/ha	41.8	24.4	94.9	10.01	4.90	6.30	237
T_6	- PE application of dried sunflower stalk solution on w/v basis @ 1:10 lit/ha *fb* HW at 60 DAT	55.2	31.9	114.2	4.04	2.40	3.50	284
T_7	- Mechanical weeding twice using twin wheel hoe weeder on 30 & 60 DAT	43.2	24.9	100.5	6.30	2.90	5.80	268
T_8	- Hand weeding twice on 30 & 60 DAT	45.3	26.4	105.1	5.10	2.70	5.20	280
T_9	- Weed free check	60.9	36.5	138.9	0.00	0.00	0.00	338
T_{10}	- Unweeded Check	26.4	15.1	62.3	90.50	22.70	62.70	117
SEd		3.0	1.7	6.7	2.38	0.62	1.72	16
CD (P=0.05)		6.3	3.6	14.2	5.01	1.31	3.61	34

PE-Pre Emergence; DAT- Days after Transplanting; HW- Hand Weeding; *fb*- Followed by

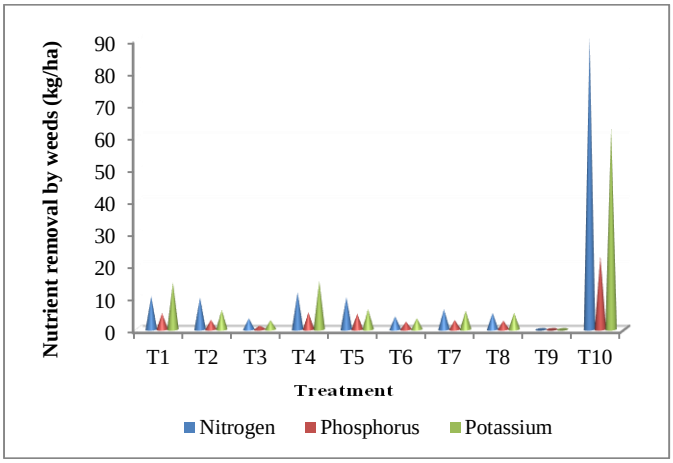

Fig 1: Effect of non-chemical weed management practices on nutrient removal by weeds (kg/ha) in organic brinjal

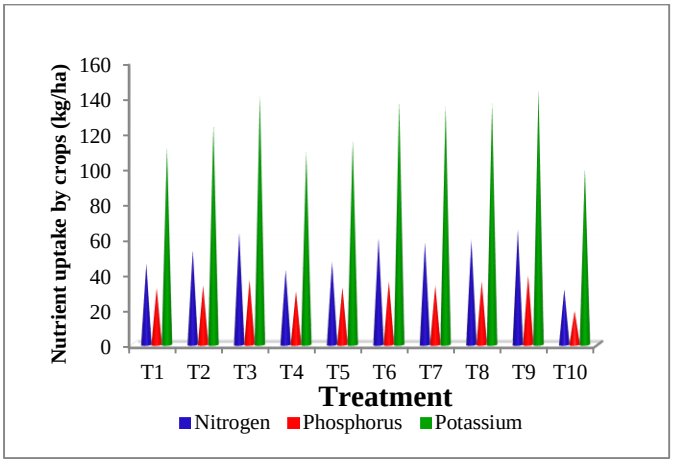

Fig 2: Effect of non-chemical weed management practices on nutrient uptake by organic brinjal (kg/ha)

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