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Effect of organic weed management practices on growth parameter, nutrient content and nutrient uptake by baby corn (*Zea mays* L.)

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Abstract
An experimental study was conducted on effect of organic weed management practices on growth parameter, nutrient content and nutrient uptake by baby corn was carried out in *kharif* 2021 at instructional farm, Agronomy MPUAT, Udaipur. The field experiments were laid out in RBD which were replicated thrice with 12 treatments. Different non chemical weed management practices were mixed properly and used as treatments in the trial. The nutrient content in baby corn cob and fodder found to be statistically non-significant, but the LAI, Total chlorophyll content and nutrient uptake by both cob and fodder were significant. The maximum uptake of nitrogen, phosphorous and potassium was reported in plastic mulch treated plot *i.e.*, stale seedbed preparation *fb* plastic mulch at sowing which was statistically at par with soil solarization *fb* plastic mulch sowing.

Keywords: Baby corn, organic, nutrient content, uptake

Introduction
Baby corn (*Zea mays* L.) is a young and unfertilized cob of the corn plant, which is harvested when the silk emerged (1 to 3 cm). It can be grown for human consumption as fresh young cob in different dishes or in a processed form. It is one of the nutritious crop rich in iron and phosphorous, and also a more popular vegetable because of its crispness, sweetness and flavor. Generally, the standards of baby corn for the fresh market or processing are 4 to 9 cm cob length and 1.0 to 1.5 cm cob diameter and good quality, i.e., yellow colour, unfertilized, straight ovary row arrangement, size within factory specifications and unbroken ear. Baby corn crop is harvested in about 50 to 70 days, it is possible to take multiple baby corn crops from same land thereby increasing the cropping intensity (Varsha, 2016) [10].

Among the several factors, most critical for the low yield of maize appears to be the weeds competing with the crop for nutrients, water, sunlight and space and deprive the crops from vital resources (Das *et al.*, 2016) [1]. Maize crop is severely affected by the weeds due to wider row spacing and slow initial growth, which favours the growth of weeds. This ultimately reduces the yield of crop and may also cause problems during harvest and reduce the quality of products. In India, the manual method of weed control is quite popular and effective. Due to intensification, diversification of agriculture and urbanization labour has become non-availability and costly (Kalia and Gupta, 2004) [4]. At the same time, the continuous use of the same group of herbicides over a period of time on a same piece of land leads to ecological imbalance in terms of weed shift, herbicide resistance and environmental pollutions (Sushilkumar *et al*., 2005) [9].

In organic farming, the use of herbicides is not permitted and therefore, non-chemical methods of weed control involving stale seedbed, soil solarization, mulching, crop rotation, intercropping and physical methods of weed control are the best alternatives and provide effective and acceptable weed control for realizing high production. However, complete control of weeds, especially in a mixed stand of annual and perennial weeds can't be achieved by using only one method alone in cropped fields (Yadav *et al*., 2020) [12]. Under such situations, the integration of pre-sowing weed management practices followed by post-sowing interculture to achieve satisfactory weed control up to critical period of crop- weed competition in crops is indispensable in organic farming (Ehsas *et al*., 2016) [2].

Materials and Methods

The experiment was conducted during *kharif* 2020 at Instructional Farm, Agronomy, Rajasthan College of Agriculture, MPUAT, Udaipur. The soil of the experimental site was slightly alkaline reaction (pH 7.8) with clay loam in nature having bulk density 1.46 g cc^{-1} and electrical conductivity 0.78 dS m^{-1}. The minimum and maximum relative humidity ranged between 58.10 to 83.90 per cent and 78.00 to 95.70 per cent, respectively during the research period. The nutrient status of the soil present in research plot recorded that organic carbon content (0.71%), available nitrogen content (254.80 kg ha^{-1}), available phosphorus content (19.34 kg ha^{-1}) and available potassium content (270.88 kg ha^{-1}) depicting overall medium nutrient status of the soil. The field experiments were laid out in RBD replicated thrice with 12 treatments. The treatments detail are T_1-stale seedbed preparation *fb* interculture at 20 DAS *fb* mechanical weeding at 40 DAS,T_2-stale seedbed preparation *fb* straw mulch (5 t ha^{-1}) at 20 DAS *fb* inter culture at 20 DAS *fb* hand weeding at 40 DAS,T_3- stale seedbed preparation *fb* plastic mulch at sowing, T_4-soil solarization *fb* interculture at 20 DAS *fb* mechanical weeding at 40 DAS,T_5-soil solarization *fb* straw mulch (5 t ha^{-1}) at 20 DAS *fb* interculture at 20 DAS *fb* hand weeding at 40 DAS, T_6-soil solarization *fb* plastic mulch at sowing, T_7-stale seedbed preparation *fb* sesbania as smothering crop in between rows and used same as mulch after 30 days *fb* one hand weeding at 40 DAS, T_8-soil solarization *fb* sesbania as smothering crop in between rows and used same as mulch after 30 days *fb* one hand weeding at 40 DAS,T_9- Interculture at 20 DAS *fb* straw mulch (5 t ha^{-1}), T_{10}-Interculture at 20 DAS *fb* mechanical weeding at 40 DAS,T_{11}-Straw mulch (5 t ha^{-1}) at 20 DAS + hand weeding at 20 days and T_{12}-weedy check. "G-5414" hybrid of baby corn which is having 50-55 days duration was used in the research study and sown on July 12, 2020 and harvested between 14- 22 September 2020. The seed rate of baby corn is 25 kg ha^{-1} and sowing was done manually. One irrigation was given just after sowing to ensuring proper germination of seeds. The plants were protected against pests and diseases as per the guidelines of the National Programme of Organic Production. All the cobs were harvested within 3-4 hand pickings. The chemical analysis of plants for the nutrient content was done after harvesting when plant samples were subjected to oven drying (65 ^{0}C). Plant analysis for the determination of nutrient content in baby corn cob and fodder were done with the standard procedures *viz*., nitrogen by Alkaline $KMNO_4$ method (Subbiah and Asija, 1956) [8], phosphorus by Olsen's method (Olsen *et al*. 1954) [6] and potassium by flame photometer (Jackson, 1973) [3]. Total chlorophyll content calculated by using SPAD Meter. One representative leaf from each category was measured for its maximum length (leaf base to tip) and maximum breadth (widest point to leaf lamina) and the leaf area of the particular category was obtained by multiplying the factor 0.796 and number of leaves in a particular category (Balakrishnan *et al.* 1987). The leaf area $plant^{-1}$ was calculated by summing up area under each category of leaves. The leaf area index (LAI) which is defined as leaf area per unit land area. LAI was computed by the following formula (Watson, 1947).

$$\text{Leaf area index} = \frac{\text{Leaf area plant}^{-1}\ (\text{cm}^{-2})}{\text{Ground area occupied plant}^{-1}\ (\text{cm}^{-2})}$$

The uptake of nitrogen, phosphorus and potassium were done by the following formula

$$\text{Nutrient uptake (kg ha}^{-1}\text{) by seed or haulm} = \frac{\text{Nutrient content (\%) in cob or fodder X cob and fodder yield (kg ha}^{-1}\text{)}}{100}$$

Results and Discussion

Effect on LAI and chlorophyll content

An assessment of data given in Table 1 indicate that all organic weed management practices had significantly increased the leaf area index and Total chlorophyll content of baby corn at this stage of observation over weedy check (2.97 and 32.83 respectively). The maximum LAI and total chlorophyll content recorded in the treatment T_3- stale seedbed *fb* plastic mulch at sowing (4.11 and 40.23 respectively) which was statistically at par with T_6- soil solarization *fb* plastic mulch at sowing (4.04 and 40.04 respectively). these treatments are superior to rest of the treatment.

The maximum leaf area index due to plastic mulch provided favourable condition to have greater uptake of nutrients and water reflected on full expansion of leaves and higher leaf area index Amini *et al*. (2014). The possibility of increased chlorophyll content was that chlorophyll is the essential photosynthetic pigment of light reaction and under plastic mulch there was no competition for light between crops and weeds. Increased absorption of chlorophyll to a greatest amount reflected in increased dry matter accumulation in line with Helaly *et al*. (2017).

Effect on nutrient content in baby corn cob and fodder

An elucidation of data given in Table 1 reflected that various organic weed management practices did not affect the nitrogen, phosphorus and potassium content in baby corn cob and green fodder significantly.

Table 1: Effect of weed management practices on growth parameters of organic baby corn

Treatments	Total chlorophyll at 45 DAS	LAI (45 DAS)
T_1	35.53	3.29
T_2	38.33	3.80
T_3	40.23	4.11
T_4	35.50	3.22
T_5	38.23	3.73
T_6	40.04	4.04
T_7	33.90	2.83
T_8	34.21	2.91
T_9	36.33	3.51
T_{10}	32.67	2.83
T_{11}	36.00	3.50
T_{12}	32.83	2.97
S.Em ±	0.55	0.06
CD (at 5%)	1.61	0.16

Effect on nutrient uptake by baby corn cob and fodder

Nitrogen uptake by cob and fodder

An investigation of data presented in Table 2 show that all the organic weed management practices significantly increased the nitrogen uptake by cob and fodder over weedy check (17.29 and 22.97 kg ha^{-1} respectively). Maximum nitrogen uptake by the cob and fodder recorded in the treatment T_3-stale seed *fb* plastic mulch at sowing (60.45 and 62.05 kg ha^{-1} respectively) which was being at par with the treatment T_6-

soil solarization *fb* plastic mulch at sowing (59.16 and 60.34 kg ha^{-1}). These treatments were followed by T_2- (52.55 and 50.42 kg ha^{-1}) and T_5- (52.49 and 52.13 kg ha^{-1}) and found significantly superior over rest of the treatments.

Table 2: Effect of weed management practices on nitrogen, phosphorus and potassium content in organic baby corn cob and green fodder at harvest

Treatments	Nitrogen (%)		Phosphorus (%)		Potassium (%)	
	Baby corn cob	Green fodder	Baby corn cob	Green fodder	Baby corn cob	Green fodder
T_1	1.674	0.618	0.273	0.103	0.449	1.124
T_2	1.698	0.621	0.274	0.105	0.456	1.126
T_3	1.738	0.657	0.302	0.104	0.486	1.203
T_4	1.649	0.626	0.275	0.103	0.447	1.131
T_5	1.712	0.657	0.280	0.102	0.481	1.151
T_6	1.736	0.660	0.276	0.102	0.486	1.172
T_7	1.712	0.666	0.305	0.105	0.491	1.165
T_8	1.729	0.660	0.305	0.109	0.492	1.166
T_9	1.635	0.655	0.301	0.109	0.447	1.169
T_{10}	1.630	0.657	0.299	0.108	0.463	1.140
T_{11}	1.611	0.662	0.275	0.102	0.459	1.146
T_{12}	1.551	0.595	0.276	0.099	0.456	1.133
S.Em ±	0.04	0.02	0.01	0.01	0.01	0.02
CD (at 5%)	NS	NS	NS	NS	NS	NS

Phosphorous uptake by cob and fodder

Compared to weedy check, weed control through all means under experimentation significantly increased phosphorus uptake by both cobs and green fodder (Table 2). While highest uptake was accounted by T_3-stale seedbed *fb* plastic mulch (20.32 kg ha^{-1}), its effect was statistically alike with T_6-soil solarization *fb* plastic mulch (18.69 kg ha^{-1}). These two treatments were followed by T_2-stale seedbed preparation *fb* straw mulch (5 t ha^{-1}) at 20 DAS *fb* interculture at 20 DAS *fb* hand weeding at 40 DAS and T_5-soil solarization *fb* straw mulch (5 t ha^{-1}) at 20 DAS *fb* interculture at 20 DAS *fb* hand weeding at 40 DAS. The lowest value of was recoded in weedy check (6.87 kg ha^{-1}).

Potassium uptake by cob and fodder

A significant increase in potassium uptake by crop was brought about by applying different organic weed management practices in comparison to weedy check (Table 2). The maximum amount of potassium uptake observed in treatment T_3-stale seedbed *fb* plastic mulch (130.33 kg ha^{-1}), which was statistically insignificant with T_6-soil solarization *fb* plastic mulch (123.73 kg ha^{-1}). The lowest value of total potash uptake by cob and fodder was seen in weedy check which recorded 48.59 kg ha^{-1}.

The marked improvement in nitrogen, phosphorus and potassium uptake in grain and fodder of baby corn seems to be on account of indirect effect of dry matter accumulation of weeds and green baby corn cobs yield negatively correlated, reduction in weed dry matter accumulation under different organic weed management practices was accompanied by corresponding reduction in per hectare removal of nitrogen, phosphorus and potassium. This was also due to higher availability of soil moisture, optimum NPK nutrients and uptake with mulching which helped in establishing the roots, initiating more growth, their subsequent retention and development in the plant leading to the higher yield attributes and other parameters in the same line as reported by Kandasamy (2017) [5]. A significant influenced on these nutrients uptake by baby corn con and stover due to application of organic weed management practices increased microbial population and resulted in increased carbon and plant nutrient mineralization rates in soil (Verma and Choudhary, 2020 and Patel *et al*. 2013) [11, 1].

Table 3: Effect of weed management practices on nitrogen, phosphorus and potassium uptake by organic baby corn cob and green fodder at harvest

Treatments	Nitrogen (kg ha^{-1})			Phosphorus (kg ha^{-1})			Potassium (kg ha^{-1})		
	cob	fodder	Total	cob	fodder	Total	cob	Fodder	Total
T_1	39.70	37.92	77.61	6.46	6.29	12.76	10.68	68.96	79.63
T_2	52.55	50.42	102.97	8.46	8.53	16.99	14.11	91.18	105.29
T_3	60.45	62.05	122.50	10.52	9.80	20.32	16.91	113.42	130.33
T_4	38.56	37.77	76.33	6.40	6.17	12.57	10.43	68.12	78.55
T_5	52.49	52.13	104.63	8.57	8.09	16.66	14.73	91.50	106.24
T_6	59.16	60.34	119.50	9.40	9.30	18.69	16.57	107.16	123.73
T_7	37.21	37.39	74.60	6.65	5.95	12.60	10.68	65.96	76.64
T_8	36.94	36.76	73.70	6.51	6.08	12.59	10.50	64.88	75.39
T_9	45.28	49.61	94.89	8.35	8.28	16.62	12.38	88.55	100.93
T_{10}	37.42	34.35	71.77	6.86	5.65	12.51	10.63	59.57	70.20
T_{11}	43.62	44.93	88.55	7.47	6.94	14.41	12.46	77.84	90.30
T_{12}	17.29	22.97	40.26	3.04	3.84	6.87	5.10	43.49	48.59
S.Em ±	1.96	2.53	3.34	0.40	0.40	0.51	0.61	3.65	3.45
CD (at 5%)	5.75	7.40	9.80	1.17	1.17	1.48	1.78	10.71	10.11

Conclusion

With the view of above-mentioned results due to the effect of different organic weed management practices on the LAI, Chlorophyll content, nutrient content and uptake by baby corn, it is reported that nutrient content in cob and fodder was not found significantly different, but the maximum LAI, Total chlorophyll content and nutrient uptake of nitrogen, phosphorous and potassium was found in stale seedbed preparation *fb* plastic mulch at sowing which was statistically at par with soil solarization *fb* plastic mulch at sowing.

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