Influence of various weed management options on weed dry matter, yield attributes and yield of sweet corn (*Zea mays* L. *saccharata*) under organic production system

ABSTRACT

A field experiment was conducted at Instructional cum Research Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) during *kharif* 2019 entitled ~~with~~ **"Influence of various weed management options on weed dry matter, yield attributes and yield of sweet corn (*Zea mays* L. *saccharata*) under organic production system"**. The soil of the experimental site was clayey in texture, neutral in

reaction and low in nitrogen, medium in phosphorus and high in potassium. The experiment was laid out in Randomized Block Design with three replications. The weed flora of the experimental site was dominated ~~with~~ by *Echinocloa colona*, *Alternanthera sessilis*, *Parthenium hysterophorus*, *Cyperus iria*. Results revealed that the highest green cob yield of sweet corn was recorded in stale seed bed + reduced spacing (up to 25%) + mulching with paddy straw + 20 DAS hand weeding (7.63t ha^{-1}) which was 83.48% higher than the weedy check. The green cob yield in stale seed bed + reduced spacing (up to 25%) + mulching with paddy straw + 20 DAS hand weeding ~~which~~ was found to be at par with mulching with waste polythene bags(ITK-

practices)(7.45t ha^{-}), hand weeding twice carried out at 20 and 40 DAS (7.33 t ha^{-1}) and soil solarization with 25µ polythene mulch during summer + one hand weeding at 20 DAS(6.94t ha^{-1}). Although grain yield in other weed management practices was significantly lower than stale seed bed + reduced spacing (upto 25%) + mulching with paddy straw + 20 DAS hand weeding treatments but higher than weedy check ~~treatment~~. Similarly, As regards ~~to~~ total weed dry weight at harvest, the total lowest weed dry weight was observed in stale seed bed + reduced spacing (upto 25%) + mulching with paddy straw + hand weeding at 20 DAS(3.45gm^{-2}) followed by mulching with waste polythene bags (ITK- practices)(4.71 gm^{-2}), hand weeding at 20 and 40 DAS (4.96gm^{-2})and soil solarization

with 25µ polythene mulch during summer + one hand weeding at 20 DAS(5.08 gm^{-2}). However, higher WCE was noticed in these treatment over weedy check. The weedy check was significantly inferior in all the yield attributes and green cob yield of sweet corn.

Keywords : Stale seed bed**,** sweet corn (*Zea mays* L. *saccharata*), weed dry matter and weed control efficiency.

INTRODUCTION

In the world Maize (*Zea mays*) is ~~the~~ a very important crop. After rice and wheat. maize keeps third position in crops. Maize was the first cereal grain ~~which~~ to be domesticated by indigenous peoples in southern Mexico about 10,000 years ago. Corn is the very important food of a wide population

of the world's communities and one of the economically main crops in the world. Maize is generally grown early ~~age~~ for grain purpose and in the second for fodder. It has potential

for high production; there is no cereal on ~~the~~ earth which has ~~very~~ such good potentiality and it's reason for maize being called 'Queen of cereals'. Maize utilizes solar radiation very ~~accurately~~ effeciently even at higher radiation intensity. All these characteristic features make maize a "Miracle crop".

Maize is grown in 9380 thousand hectare area in India and its production is 28753 thousand tonne with productivity of 3065 kg/ha (Indiastat, 2017-18). Maize is grown in 133.41 thousand hectare with production and productivity of 317.52 thousand tonne & 2380 kg ha^{-1} respectively in Chhattisgarh (Indiastat, 2017-18).

In the *kharif* season emergence of maize and weed start simultaneously and first 20-30 Days are most critical to crop-weed competition. Yield reduction in maize ranges from 28 to 93%, depending on the weed population and flora and duration of crop-weed competition. Hand weeding at 20 and 40 DAS may lead to cost effective control of the weeds. The losses caused by weeds exceed the losses from any other category of agricultural pests (Sharma *et al*. 2010). Weeds compete with the crop plants for sunlight, moisture and nutrients (Kumar *et al*. 2013 and Saeed *et al*. 2013) and deprive the crops from vital resources (Lehocky and Reisinger 2003). Due to wide spaced crop, maize suffers from heavy weed infestation during kharif season. The study was carried out to find economically effective method of weed control for realising higher productivity and profitability of *kharif* sweet corn.

MATERIALS AND METHODS

The study was carried out during *kharif* season of 2019-2020. The experiment site was located at the Instructional cum Research Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur, (C.G.). The type of soil in experiment field was clayey soil in texture with containing low nitrogen, medium phosphorus and high potassium. Sweet corn variety 'sugar-75' was used in the experiment. The mean temperature ranged from 24.16ºC to 35.67ºC during *kharif* season. The crop was sown on 15th July with the seed rate 3.5 kg ha^{-1}at spacing of 60cm × 20cm except 4.5 kg ha^{-1} with spacing 45cm × 20cm in stale seed bed + reduced spacing (up to 25%) + mulching with paddy straw + hand weeding at 20 DAS(W_4). Standard organic package of practices was followed through the cropping season. The crop was harvested on 2nd and 10th October. The field experiment was carried out in randomized block design with three replications. The treatment comprised of nine weed management practices W_1- Hand weeding at 20 and 40 DAS, W_2- One mechanical weeding at 20 DAS + one hand weeding at 40 DAS, W_3 - Intercropping with black gram(1:1), W_4- Stale seed bed + reduced spacing (up to 25%) + mulching with paddy straw + hand weeding at 20 DAS, W_5- Locally

available weed mulch (*Lantana camera*) + one hand pulling at 20 DAS, W_6-Incorporation of neem cake 15 days before sowing, @ 5 tonnes/ha + hand weeding at 20 DAS, W_7-Soil solarization with 25µ polythene mulch during summer + one hand weeding at 20 DAS, W_8- Mulching with waste polythene bags (ITK- practices) and W_9 -Weedy check. The plot size was 5.40 m × 4.20m(22.68m^2).

Soil solarization in summer season, stale seed bed prepared before 20 days of sowing and neem cake was applied before 15 day of sowing. Weeding was done by labour and hoe. In manual weed control weeds were uprooted and removed at 20 and 40 DAS as per the treatment. In weedy check there was no ~~any~~ weeding practices ~~was~~ applied.

Growth and yield attributes like plant height, dry matter accumulation, number of leaf, and yields parameters were recorded at harvest of the crop. Weed density (grasses, broad leaf and sedges) was counted at 20 , 40 ,60 and at harvest using 0.25m^2 quadrate from each plot. Weeds which were found in the quadrate were carefully uprooted along with the roots. The roots of the samples were cut and only the aerial parts were cleaned, sum-dried and finally

oven-dried at 60ºC for 48 hours. The dry matter was noted species wise and total dry matter expressed as gm^{-2}. Weed control efficiency and weed index (WI) were calculated by the formulae suggested by Mani *et al*.(1973).

$$\text{Weed control efficiency(WCE\%)} = \frac{\text{DWC-DWT}}{\text{DWC}} \times 100$$

Where,

WCE =Weed control efficiency(%)

DWC =Dry weight of weeds in weedy check plot

DWT = Dry weight of weeds in treated plot

Weed index was expressed in % and worked out by using the formula given below(Gill and Kumar, 1969).

$$\text{Weed index (\%)} = \frac{\text{Maximum cob yield} - \text{Cob yield from treated plot}}{\text{Maximum cob yield}} \times 100$$

The data obtained on various parameters were tabulated and subjected to statistical analysis. The data on weed density and dry matter production of weed was subjected to square root transformation i.e. before carrying analysis of variance. The levels of treatment was tested with ‘F’ test shown their significance, the levels of treatment were compared by critical difference at 5 % level of probability. The skeleton of analysis of variance and formula used for various estimations are given below (Gomez and Gomez, 1984).Gross return (money income from cob and stover yields), net returns(monetary income obtained after deducting cost of cultivation from gross returns) and B:C ratio (gross returns divided by cost of cultivation) were calculated using prevailing market price of inputs (including treatments), labours and produce for assessing the economic viability of treatments.

RESULT AND DISCUSSION

WEED FLORA

The weed flora in the experiment site constituted by grass *viz*., *Echinocloa colona*, broad leaf weed *viz*., *Alternanthera sessilis*, *Parthenium hysterophorus*, Sedges *viz*.,*Cyperus iria* and others weed *spp*.

CROP GROWTH AND YIELD

Growth and yield attributes as well as cob and stover yield were significantly influenced by different weed control measures (Table1). Result recorded that significantly the highest cob length(17.09 cm), cob diameter (4.20cm), number of cobs per plant(1.60), Cob weight (164.4g), number of rows cob^{-1} (15.5),number of grain rows^{-1} (32.1), number of grains cob^{-1} (489.0), green cob yield(7.63t ha^{-1}) and stover yield(19.03t ha^{-1})) were recorded in stale seed bed + reduced spacing (upto 25%) + mulching with paddy straw + 20 DAS hand weeding which was found at par with in mulching with waste polythene bags (ITK-practices), hand weeding at 20 and 40 DAS and soil solarization with 25µ polythene mulch during summer + one hand weeding at 20 DAS. The improved growth and yield attributes under these treatments might be due to stale seed bed, paddy straw mulching and periodical removal of weeds by hand weeding as per the treatment by less

number of weeds and dry weight of weeds (Table3&4), which might have maintained soil fertility status and moisture content by means of less removal of plant nutrient and moisture by weeds. These findings are in close conformity with those reported by Sinha *et al*., Kolage *et al*., Mandal *et al*., Kamble*et al*. And Desmukh *et al*. Similarly, Mulched biomass added large quantity of nutrients and the additional nutrients over that applied through manure might have contributed to the increased yield of maize (Sharma and Achrya., 2000 and Sharma *et al*.2010). Different weed management practices made impact on weed dry weight which directly influenced on different yield parameters and yield also.

WEED PARAMETERS

The weed management treatments significantly influenced the weed dry weight(Table 3) The stale seed bed + reduced spacing (upto 25%) + mulching with paddy straw + 20 DAS hand weeding recorded significantly lower weed dry weight. At 60 DAS and at harvest. The weed dry weight of the stale seed

bed + reduced spacing (upto 25%) + mulching with paddy straw + 20 DAS hand weeding followed by hand weeding at 20 and 40 DAS, one mechanical weeding at 20 DAS and hand weeding at 40 DAS, waste polythene bags (ITK-practices, and soil solarization with 25µ polythene mulch during summer + one hand weeding at 20 DAS. A perusal of data presented in (Table9) Indicated that the minimum weed index was recorded (0.00%) in stale seed bed + reduced spacing (upto 25%) + mulching with paddy straw + 20 DAS hand weeding which was followed by (2.36%) in mulching with waste polythene bags, (3.93%) in hand weeding at 20 and 40 DAS. These might be attributed to the effective control of weeds under these treatments, which reflected in less number of weeds and ultimately lower biomass. Similar findings also Adekalu *et al*. (2008) reported that mulched promote crop development and early harvests and increase yields. Similarly, the plastic mulch covered the soil, prevented early weed ~~recruitment~~ emergence through acting as physical barrier and through solarization effect(Stapleton, 1990; Ogunyemi*et al* ; 2007) and would be due to lower weed index also close conformity with those reported by Sinha *et al*., Kolage *et al*. And Verma *et al*.

The weedy check recorded significantly the highest weed dry weight of weeds owing to uncontrolled condition favoured luxurious weed growth leading increased dry matter of weeds(Table3&4). Similar findings also weed infestation during germination to 45 days after sowing (DAS) cause maximum reduction yield Das *et al*. (2013).

Table 1: Plant growth parameters of *kharif* sweet corn as influenced by various weed management practices at different time interval

Treatments	Plant height(cm				Dry matter accumulation (g plant^{-1})				Number of leaf plant^{-1}				Leaf area(cm^2 plant^{-1})				Leaf area index			
	20 DAS	40 DAS	60 DAS	AH	20 DAS	40 DAS	60 DAS	AH	20 DAS	40 DAS	60 DAS	AH	20 DAS	40 DAS	60 DAS	AH	20 DAS	40 DAS	60 DAS	AH
W_1	22.1	93.4	154.7	174.3	5.4	23.2	85.0	158.5	4.40	6.23	11.93	6.77	158.5	1169.2	1445.4	1205.6	0.13	0.97	1.20	1.01
W_2	21.6	90.4	149.8	167.7	5.3	21.4	80.3	150.4	4.37	6.20	10.23	6.17	154.3	1130.1	1343.2	1140.9	0.13	0.94	1.12	0.95
W_3	20.7	83.7	120.9	127.4	4.7	18.7	58.6	104.1	4.33	5.53	9.93	5.22	153.2	958.4	1056.2	998.4	0.13	0.8	0.88	0.83
W_4	22.4	94.1	160.8	181.9	6.4	25.8	90.2	165.4	4.49	6.50	12.27	7.73	159.7	1223.2	1469.5	1256.4	0.18	1.36	1.63	1.40
W_5	21.8	90.3	137.7	161.4	5.1	20.0	68.5	124.7	4.33	6.00	9.13	5.40	156.9	1001.7	1111.2	1030.0	0.13	0.83	0.92	0.86
W_6	21.3	90.4	143.6	168.0	5.2	22.0	72.8	132.3	4.33	6.20	9.67	5.93	155.2	1029.1	1126.5	1040.4	0.13	0.86	0.94	0.87

W_7	21.3	92.0	153.8	173.5	5.5	22.2	83.8	155.7	4.27	6.20	11.67	6.57	157.6	1152.8	1443.8	1203.8	0.13	0.96	1.21	1.01
W_8	22.3	94.0	157.7	176.8	5.9	25.1	87.8	161.3	4.40	6.47	12.07	7.03	159.4	1217.7	1453.8	1230.7	0.13	1.01	1.21	1.02
W_9	20.5	56.9	103.5	110.2	5.3	16.6	50.6	89.5	4.30	5.20	9.07	5.23	153.5	775.7	963.4	792.0	0.13	0.64	0.8	0.66
SEm ±	**0.33**	**1.04**	**2.39**	**2.84**	**0.35**	**0.45**	**2.91**	**3.24**	**0.12**	**0.16**	**0.45**	**0.39**	**3.70**	**46.2**	**36.4**	**37.5**	**0.00**	**0.04**	**0.03**	**0.03**
CD(P=0.05)	**0.99**	**3.10**	**7.18**	**8.52**	**1.04**	**1.36**	**8.72**	**9.72**	**NS**	**0.48**	**1.36**	**1.18**	**NS**	**138.52**	**109.21**	**112.51**	**0.01**	**0.12**	**0.10**	**0.09**

Table 2: Yield parameters of *kharif* sweet corn as influenced by various weed management practices at different time interval

Treatments	**Number of cob palnt^{-1}**	**Cob length (cm)**	**Green cob diameter (cm)**	**Cob weight (g)**	**Number of row cob^{-1}**	**Number of grain row^{-1}**	**Number of grains cob^{-1}**	**Green cob yield (t ha^{-1})**	**Stover yield (t ha^{-1})**
W_1- HW at 20 and 40 DAS	1.5	16.5	4.1	157.2	15.4	28.6	477.3	7.33	17.52
W_2-1MW at 20 DAS + 1HW at 40DAS	1.3	13.7	3.7	145.2	14.3	27.6	425.6	6.37	15.06
W_3- IC with black gram(1:1)	1.1	10.5	3.6	92.5	12.1	23.7	313.6	4.97	11.37
W_4- SSB+RS (upto 25%)+ MPS +HW at 20 DAS	1.6	17.1	4.2	164.4	15.5	32.2	489.0	7.63	19.03
W_5- WM+ 1HP at 20 DAS-	1.2	12.7	3.7	112.7	13.2	25.8	380.5	5.86	13.10
W_6- ICP NC + HW at 20 DAS	1.3	13.1	3.7	138.4	13.3	26.1	391.6	5.88	13.28

W_7- SS + 1 HW at 20 DAS	1.5	16.1	4.0	154.4	14.8	27.9	449.1	6.94	15.91
W_8- (ITK-practices)	1.5	16.6	4.2	160.6	15.4	31.4	483.7	7.45	17.81
W_9- Weedy check	1.0	7.3	3.3	73.5	11.6	18.0	212.7	1.26	2.80
SEm ±	**0.05**	**0.34**	**0.13**	**3.39**	**0.25**	**1.51**	**14.47**	**0.35**	**1.05**
CD(P=0.05)	**0.15**	**1.01**	**0.38**	**10.45**	**0.75**	**4.53**	**43.38**	**1.05**	**3.15**

Table3: Weed dry weight of *kharif* sweet corn as influenced by various weed management practices at 20 DAS

Treatments	Weed dry weight (gm^{-2}), 20 DAS					
	Echinochloa colona	***Alternanthera sessilis***	***Parthenium hysterophorus***	***Cyperus Iria***	**Others**	**Total**
W_1-Hand weeding at 20 and 40 DAS.	**2.62** (6.38)	**2.47** (5.62)	**2.40** (5.28)	**2.98** (8.39)	**1.94** (3.29)	**5.42** (28.96)
W_2-One mechanical weeding at 20 DAS + one hand weeding at 40DAS.	**2.14** (4.10)	**2.14** (4.10)	**2.18** (4.27)	**3.17** (9.59)	**2.38** (5.20)	**5.26** (27.26)
W_3-Intercropping with black gram(1:1).	**1.72** (2.47)	**2.08** (3.84)	**2.12** (4.02)	**2.03** (3.63)	**2.42** (5.38)	**4.45** (19.34)
W_4-Stale seed bed + reduced spacing (upto 25%) + mulching with paddy straw + hand weeding at 20 DAS.	**0.98** (0.48)	**1.21** (0.98)	**1.09** (0.69)	**1.00** (0.52)	**1.24** (1.05)	**2.05** (3.72)

W_5-Locally available weed mulch (*Lantana camera*) + one hand pulling at 20 DAS.	**2.01** (3.57)	**1.97** (3.40)	**2.16** (4.20)	**2.09** (3.90)	**2.18** (4.27)	**4.45** (19.34)
W_6-Incorporation of neem cake 15 days before sowing, 5 tonnes ha^{-1}+ hand weeding at 20 DAS.	**2.07** (3.79)	**1.94** (3.27)	**2.13** (4.05)	**2.07** (3.82)	**2.21** (4.40)	**4.45** (19.33)
W_7-Soil solarization with 25µ polythene mulch during summer + one hand weeding at 20 DAS.	**1.59** (2.03)	**1.68** (2.33)	**1.87** (3.02)	**1.59** (2.04)	**1.70** (2.40)	**3.53** (12.00)
W_8-Mulching with waste polythene bags (ITK-practices).	**1.30** (1.20)	**1.54** (1.90)	**1.21** (0.98)	**1.34** (1.31)	**1.34** (1.30)	**2.68** (6.69)
W_9-Weedy check.	**2.28** (4.73)	**2.48** (5.67)	**2.18** (4.26)	**2.98** (8.40)	**3.13** (9.30)	**5.73** (32.36)
SEm±	**0.13**	**0.12**	**0.15**	**0.15**	**0.10**	**0.09**
CD (P=0.05)	**0.39**	**0.36**	**0.45**	**0.46**	**0.30**	**0.27**

Note* Data in parenthesis are pre transformed originals value, which were transformed to ($\sqrt{x}$+0.5) and analysed statistically

Table 4: Weed dry weight of *kharif* sweet corn as influenced by various weed management practices at 40 DAS

Treatments	Weed dry weight (gm^{-2}), 40 DAS					
	Echinochloa Colona	***Alternanthera sessilis***	***Parthenium hysterophorus***	***Cyperus iria***	**Others**	**Total**
W_1-Hand weeding at 20 and 40 DAS.	**1.54** (1.89)	**1.46** (1.66)	**1.93** (3.24)	**2.12** (4.01)	**1.92** (3.20)	**3.8** (14.00)
W_2-One mechanical weeding at 20 DAS + one hand weeding at 40DAS.	**1.93** (3.26)	**1.42** (1.53)	**1.91** (3.17)	**2.21** (4.39)	**1.86** (2.96)	**3.97** (15.31)
W_3-Intercropping with black gram(1:1).	**2.97** (8.38)	**2.81** (7.42)	**2.57** (6.13)	**2.53** (5.95)	**3.18** (9.63)	**6.16** (37.51)
W_4-Stale seed bed + reduced spacing (upto 25%) + mulching with paddy straw + hand weeding at 20	**0.91** (0.33)	**1.03** (0.58)	**1.03** (0.57)	**0.96** (0.43)	**1.21** (0.97)	**1.83** (2.88)

DAS.						
W_5-Locally available weed mulch (*Lantana camera*) + one hand pulling at 20 DAS.	**1.72**	**1.59**	**1.62**	**1.85**	**2.16**	**3.77**
	(2.47)	(2.03)	(2.15)	(2.94)	(4.18)	(13.77)
W_6-Incorporation of neem cake 15 days before sowing,5 tonnes ha^{-1} + hand weeding at 20 DAS.	**1.69**	**1.56**	**1.59**	**1.44**	**2.14**	**3.54**
	(2.38)	(1.95)	(2.03)	(1.59)	(4.09)	(12.04)
W_7-Soil solarization with 25µ polythene mulch during summer + one hand weeding at 20 DAS.	**1.49**	**1.60**	**1.60**	**1.55**	**1.62**	**3.23**
	(1.73)	(2.09)	(2.07)	(1.93)	(2.14)	(9.96)
W_8-Mulching with waste polythene bags (ITK-practices).	**1.46**	**1.74**	**1.56**	**1.56**	**1.67**	**3.3**
	(1.64)	(2.56)	(1.94)	(1.96)	(2.31)	(10.41)
W_9-Weedy check.	**3.84**	**3.23**	**2.98**	**3.80**	**4.78**	**8.33**
	(14.32)	(9.97)	(8.39)	(13.97)	(22.4)	(69.05)
SEm±	**0.13**	**0.15**	**0.13**	**0.12**	**0.12**	**0.11**
CD (P=0.05)	**0.39**	**0.44**	**0.39**	**0.39**	**0.36**	**0.33**

Note* Data in parenthesis are pre transformed originals value, which were transformed to ($\sqrt{x}+0.5$) and analysed statistically

Table 5: Weed dry weight of *kharif* sweet corn as influenced by various weed management practices at 60 DAS

Treatments	Weed dry weight(gm^{-2}), 60 DAS					
	Echinochloa colona	***Alternanthera sessilis***	***Parthenium hysterophorus***	***Cyperus iria***	**Others**	**Total**
W_1-Hand weeding at 20 and 40 DAS.	**1.93** (3.25)	**1.64** (2.19)	**2.08** (3.86)	**1.72** (2.48)	**1.30** (1.19)	**3.67** (12.97)
W_2-One mechanical weeding at 20 DAS + one hand weeding at 40DAS.	**1.78** (2.69)	**1.67** (2.31)	**2.04** (4.69)	**1.76** (2.61)	**1.74** (2.55)	**3.78** (13.80)
W_3-Intercropping with black gram(1:1).	**3.98** (15.38)	**3.71** (13.30)	**3.92** (14.93)	**3.35** (10.74)	**6.21** (38.16)	**9.64** (92.51)
W_4-Stale seed bed + reduced spacing (upto 25%) + mulching with paddy straw+hand weeding at 20 DAS.	**1.06** (0.64)	**1.30** (1.20)	**1.31** (1.24)	**1.09** (0.69)	**1.43** (1.56)	**2.41** (5.33)
W_5-Locally available weed mulch (*Lantana camera*) + one hand pulling at 20 DAS.	**2.07** (3.79)	**2.18** (4.29)	**2.48** (5.70)	**2.10** (3.93)	**2.53** (5.94)	**4.91** (23.65)
W_6-Incorporation of neem cake 15 days before sowing, 5 tonnes ha^{-1}+ hand weeding at 20 DAS.	**1.78** (2.69)	**2.10** (3.93)	**2.42** (5.37)	**1.82** (2.84)	**2.44** (5.49)	**4.56** (20.32)
W_7-Soil solarization with 25µ polythene mulch during summer + one hand weeding at 20 DAS.	**1.64** (2.20)	**1.94** (3.27)	**2.19** (4.30)	**1.88** (3.04)	**2.10** (3.94)	**4.07** (16.09)
W_8-Mulching with waste polythene bags (ITK-practices).	**1.67** (2.30)	**1.86** (2.97)	**1.87** (3.01)	**1.74** (2.53)	**2.00** (3.53)	**3.85** (14.30)
W_9-Weedy check.	**4.34** (18.40)	**3.74** (13.53)	**3.84** (14.26)	**4.67** (21.35)	**7.59** (57.23)	**11.19** (124.77)
SEm±	**0.12**	**0.14**	**0.10**	**0.15**	**0.18**	**0.26**
CD (P=0.05)	**0.37**	**0.43**	**0.31**	**0.44**	**0.55**	**0.77**

Note* Data in parenthesis are pre transformed originals value, which were transformed to ($\sqrt{x}+0.5$) and analysed statistically

Table 6: Weed dry weight of *kharif* sweet corn as influenced by various weed management practices at harvest

Treatments	Weed dry weight(gm^{-2}), at harvest					
	Echinochloa colona	***Alternanthera sessilis***	***Parthenium hysterophorus***	***Cyperus iria***	**Others**	**Total**
W1-Hand weeding at 20 and 40 DAS.	**2.28** (4.70)	**2.40** (5.29)	**2.43** (5.42)	**2.14** (4.12)	**2.25** (4.59)	**4.96** (24.12)
W2-One mechanical weeding at 20 DAS + one hand weeding at 40DAS.	**2.32** (4.91)	**2.42** (5.39)	**3.47** (5.65)	**2.28** (4.73)	**2.29** (4.77)	**5.09** (25.45)
W3-Intercropping with black gram(1:1).	**5.36** (28.31)	**4.54** (20.19)	**4.78** (22.36)	**5.36** (28.33)	**6.46** (41.26)	**11.87** (140.45)
W4-Stale seed bed + reduced spacing (upto 25%) + mulching with paddy straw + hand weeding at 20 DAS.	**1.23** (1.02)	**1.93** (3.25)	**2.04** (3.68)	**1.34** (1.31)	**1.64** (2.19)	**3.45** (11.45)
W5-Locally available weed mulch (*Lantana camera*) + one hand pulling at 20 DAS.	**2.55** (6.03)	**2.70** (6.84)	**2.80** (7.39)	**2.62** (6.39)	**2.81** (7.40)	**5.87** (34.05)
W6-Incorporation of neem cake 15 days before sowing, 5 tonnes ha^{-1}+ hand weeding at 20 DAS.	**2.49** (5.72)	**2.62** (6.37)	**3.03** (8.74)	**2.55** (6.04)	**2.55** (6.04)	**5.78** (32.91)
W7-Soil solarization with 25µ polythene mulch during summer + one hand weeding at 20 DAS.	**2.29** (4.78)	**2.48** (5.69)	**2.47** (5.63)	**2.24** (4.56)	**2.28** (4.70)	**5.08** (25.36)
W8-Mulching with waste polythene bags (ITK-practices).	**2.19** (4.31)	**2.18** (4.29)	**2.42** (5.39)	**2.13** (4.05)	**2.13** (4.04)	**4.71** (22.08)
W9-Weedy check.	**4.67** (21.37)	**5.60** (30.92)	**5.47** (29.5)	**6.99** (48.39)	**8.05** (64.39)	**13.96** (194.57)
SEm±	**0.21**	**0.21**	**0.18**	**0.18**	**0.18**	**0.09**
CD (P=0.05)	**0.63**	**0.37**	**0.54**	**0.53**	**0.55**	**0.26**

Note* Data in parenthesis are pre transformed originals value, which were transformed to ($\sqrt{x}+0.5$) and analysed statistically

Table 7: Total weed dry weight of *kharif* sweet corn as influenced by various weed management practice at different time interval

Treatments	Total dry weight (gm^{-2})			
	20 DAS	**40 DAS**	**60 DAS**	**At harvest**
W_1-Hand weeding at 20 DAS and 40 DAS.	**5.42** (28.96)	**3.8** (14.00)	**3.67** (12.97)	**4.96** (24.12)
W_2-One mechanical weeding at 20 DAS + one hand weeding at 40DAS.	**5.26** (27.26)	**3.97** (15.31)	**3.78** (13.80)	**5.09** (25.45)
W_3-Intercropping with black gram(1:1).	**4.45** (19.34)	**6.16** (37.51)	**9.64** (92.51)	**11.87** (140.45)
W_4-Stale seed bed + reduced spacing (upto 25%) + mulching with paddy straw + hand weeding at 20 DAS.	**2.05** (3.72)	**1.83** (2.88)	**2.41** (5.33)	**3.45** (11.45)
W_5-Locally available weed mulch (*Lantana camera*) + one hand pulling at 20 DAS.	**4.45** (19.34)	**3.77** (13.77)	**4.91** (23.65)	**5.87** (34.05)
W_6-Incorporation of neem cake 15 days before sowing, 5 tonnes ha^{-1}+ hand weeding at 20 DAS.	**4.45** (19.33)	**3.54** (12.04)	**4.56** (20.32)	**5.78** (32.91)
W_7-Soil solarization with 25µ polythene mulch during summer + one hand weeding at 20 DAS.	**3.53** (12.00)	**3.23** (9.96)	**4.07** (16.09)	**5.08** (25.36)
W_8-Mulching with waste polythene bags (ITK-practices).	**2.68** (6.69)	**3.30** (10.41)	**3.85** (14.30)	**4.71** (22.08)
W_9-Weedy check.	**5.73** (32.36)	**8.33** (69.05)	**11.19** (124.77)	**13.96** (194.57)
SEm±	**0.09**	**0.11**	**0.26**	**0.09**
CD (P=0.05)	**0.27**	**0.33**	**0.77**	**0.26**

Table 8: Weed control efficiency *kharif* of sweet corn as influenced by various weed management practices at different time interval

Treatments	Weed control efficiency(%)			
	20DAS	**40DAS**	**60DAS**	**at harvest**
W_1-Hand weeding at 20 and 40 DAS.	10.5	79.7	89.6	87.6
W_2-One mechanical weeding at 20 DAS + one hand weeding at 40DAS.	15.8	77.8	88.9	86.9
W_3-Intercropping with black gram(1:1).	40.2	45.7	25.9	27.8
W_4-Stale seed bed + reduced spacing (upto 25%) + mulching with paddy straw + hand weeding at 20 DAS.	88.5	95.8	95.7	94.1
W_5-Locally available weed mulch (*Lantana camera*) + one hand pulling at 20 DAS.	40.2	80.1	81.0	82.5
W_6-Incorporation of neem cake 15 days before sowing, 5 tonnes ha^{-1} + hand weeding at 20 DAS.	40.3	82.6	83.7	83.1
W_7-Soil solarization with 25µ polythene mulch during summer + one hand weeding at 20 DAS	62.9	85.6	87.1	87.0
W_8-Mulching with waste polythene bags (ITK-practices).	79.3	84.9	88.5	88.7
W_9-Weedy check.	-	-	-	-

Table9: Weed index, weed control efficiency and economics of *kharif* sweet corn as influenced by various weed management practic

Treatments	Weed index	Weed control efficiency	Total cost (Rs. ha^{-1})	Gross return (Rs. ha^{-1})	Net return (Rs. ha^{-1})	B:C ratio
W_1- HW at 20 and 40 DAS	3.93	87.6	64515	150104	85589	2.33
W_2-1MW at 20 DAS + 1HW at 40DAS	16.51	86.9	61995	130412	68417	2.10
W_3- IC with black gram(1:1)	34.86	27.8	59015	101674	42659	1.72
W_4- SSB+RS (upto 25%)+ MPS +HW at 20 DAS	0.00	94.1	71446	156406	84960	2.19
W_5- WM+ 1HP at 20 DAS-	23.20	82.5	61995	119820	57825	1.93
W_6- ICP NC + HW at 20 DAS	22.94	83.1	121995	120256	-1739	0.99
W_7- SS + 1 HW at 20 DAS	9.04	87.0	68875	141982	73107	2.06
W_8- ITK-practices	2.36	88.7	66614	152562	85948	2.29
W_9-Weedy check	83.49	-	56115	25760	-30355	0.46

W_1- HW at 20 and 40 DAS - Hand weeding at 20 and 40 DAS.

W_2 - 1MW at 20 DAS + 1HW at 40DAS.- one mechanical weeding at 20 DAS and hand weeding at 40 DAS.

W_3- IC with black gram(1:1)- Intercropping with black gram(1:1).

W_4- SSB + RS (upto 25%) + MPS + HW at 20 DAS- Stale seed bed + reduced spacing (upto 25%) + mulching with paddy straw + hand weeding at 20 DAS.

W_5-WM+ 1HP at 20 DAS- Locally available weed mulch (*Lantana camera*) + one hand pulling at 20 DAS.

W_6- ICP NC + HWat 20 DAS- Incorporation of neem cake 15 days before sowing, 5 tonnes ha^{-1} + hand weeding at 20 DAS.

W_7-SS + 1 HW at 20 DAS- Soil solarization with 25µ polythene mulch during summer + one hand weeding at 20 DAS.

W_8- (ITK-practices) - Mulching with waste polythene bags (ITK-practices

W_9- Weedy check - Weedy check

DAS – Days after sowing

ECONOMICS

The ~~investigated~~ data ~~resulted~~ showed that weed management practices significantly affects the, gross and net return. the highest net return recorded waste polythene bags (ITK-practices) (Rs. 85948 ha^{-1}) which was followed with, hand weeding at 20 and 40 DAS (Rs. 85589 ha^{-1}), stale seed bed + reduced spacing (upto 25%) + mulching with paddy straw + 20 DAS hand weeding (Rs. 84960 ha^{-1}), and soil solarization with 25µ polythene mulch during summer + one hand weeding at 20 DA(Rs. 73107 ha^{-1}), The lowest net return was found in Rs. -30355 ha^{-1} accrued under treatment weedy check. The highest B:C ratio value (2.33) was calculated in hand weeding at 20 and 40m DAS which was followed by mulching with waste polythene bags(2.29), stale seed bed + reduced spacing (up to 25%) + mulching with paddy straw + hand weeding at 20 DAS(2.19) and soil solarization with 25µ polythene mulch during summer + one hand weeding at 20 DAS(2.06), the higher benefit under these treatments might be due to increased monetary

returns with comparatively lower cost. These findings are close vicinity with those reported by Malviya and Singh, Rao*et al*., Sunitha*et al*.

CONCLUSION

On the basis of the result obtained from presented field study, it can be concluded that among the different weed management practices the significantly higher yield attributes, green cob and stover yield were recorded under the stale seed bed + reduced spacing (up to 25%) + mulching with paddy straw + hand weeding at 20 DAS which was found at par with mulching with waste polythene bags mulch(ITK-practices), hand weeding at 20 and 40 DAS and soil solarization with 25µ polythene mulch during summer + one hand weeding at 20 DAS. As regards to the various weed management practices the stale seed bed + reduced spacing (up to 25%) + mulching with paddy straw + hand weeding at 20 DAS treatment showed maximum weed control efficiency and minimum weed index which was followed by mulching with waste polythene bags mulch (ITK-practices), hand weeding at 20 and 40 DAS and soil solarization with 25µ polythene mulch during summer + one hand weeding at 20 DAS. The yield was positively related to percent reduction weed dry weight and weed control efficiency. Similarly, Sanodiya *et al*. (2013) stated that the maximum seed yield and stover yield were recorded under 2 hand weeding at 20 and 40 DAS followed by atarzine 1.0 kg ha^{-1} + hand weeding at 30 DAS than the other treatment. The highest net return was obtained under mulching with waste polythene bags mulch(ITK-practices) followed by hand weeding at 20 and 40 DAS and stale seed bed + reduced spacing (up to 25%) + mulching with paddy straw + hand weeding at 20 DAS and the highest B:C ratio was calculated under hand weeding at 20 and 40 DAS which was close to mulching with waste polythene bags mulch(ITK-practices)and stale seed bed + reduced spacing (up to 25%) + mulching with paddy straw + hand weeding at 20 DAS. The highest gross return was incurred in stale seed bed + reduced spacing (up to 25%) + mulching with paddy straw + hand weeding at 20 DAS. Similarly, Sharma and Gautam (2010) at the experimental site in Uttrakhand, reported maximum net returns (Rs. 18155 ha^{-1}) and Benefit : Cost ration (1.62) with two hand weeding as compared to rest of the weed control treatments. In the similar fashion, Rao *et al*. (2009) stated that hand weeding twice at 15 and 30 DAS recorded the higher gross return (68445 ha^{-1}), net return (50945 ha^{-1}) and B: C ratio(2.9) in maize.

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