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Effect of different weed management practices on yield and yield attributes of Baby Corn (*Zea mays* L.) under the temperate conditions of Kashmir valley

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ABSTRACT
A field experiment entitled 'Effect of different weed management practices on yield and yield attributes of Baby Corn (Zea mays L.) under the temperate conditions of Kashmir valley'was conducted at Mountain Livestock Research Institute (MLRI), Manasbal, (SKUAST-K) during kharif2014. The experiment comprising of 11 treatments [Farmers practice (W_1); Earthing up and weeding at 30 and 45 DAS (W_2); Atrazine @ 1.5 kg a.iha^{-1}pre-emergence at 1 DAS (W_3); atrazine @ 1.5 kg a.iha^{-1} early post-emergence at 10 DAS (W_4); straw mulch (paddy straw) at 1DAS (W_5); straw mulch (brown sarson) at 1DAS (W_6); polyethylene mulch (black) at 1DAS (W_7); polyethylene mulch (white) at 1DAS (W_8); saw mulch at 1DAS (W_9); weedy check (W_{10}) and weed free (W_{11})] was laid out in a randomised complete block design with three replications. Significant variation in yield and yield attributes was recorded among the various treatments tested. Yield and yield attributing parameters were significantly higher in weed free treatment followed by earthing up and weeding at 30 DAS and 45 DAS whereas, lowest values were recorded in weedy check.
***Key words**: Baby corrn, management, kharif, yield, atrazine, weed, mulch*

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INTRODUCTION

In India, maize (Zea mays L.) is grown on an area of 9.43 mha, with production and productivity of 24.35 mt and 2583 kg/ha, respectively (GOI, 2014). Maize has been classified in different types according to its use and/or starch content viz., Flour corn (*Zea mays* var. Amylacea) Popcorn (*Zea mays* var. Everta) Dent corn (*Zea mays* var. Indentata) Flint corn (*Zea mays* var. Indurata) Sweet corn (*Zea mays* var. Saccharata) Waxy corn (*Zea mays* var. Ceratina) Pod corn (*Zea mays* var. Tunicate) and Baby corn (*Zea mays* L.)[1].

Baby corn (*Zea mays* L.) refers to the whole, entirely edible cobs of immature corn harvested just before fertilization at 2-3 cm long silk emergence stage [1]. Baby corn is a delicious and nutritive vegetable and it is consumed as a natural food. It is very tasty, sweet and easy to consume because of its tenderness and sweetness with good nutritive value. Due to changing food preferences in Indian life style, the urban population is switching over to new food items; the 'Baby corn' is a new addition to Indian foods. Being a short duration crop, it easily fits in an intensive cropping system and in addition to baby cob it provides delicious green fodder to cattle [2].

Weeds are perceived by the farming community as being the greatest cause of yield loss in maize crop. They create a severe crop weed competition and are competing for light, water, nutrients, space, carbon dioxide etc. and increasing the cost of production. Yield losses in the range of 50-60% occur owing to absence of appropriateness, untimely and uncontrolled weed growth in maize fields and therefore needing immediate attention. Manual weeding though very effective in controlling weeds, very often is cumbersome, labour intensive, expensive and time consuming [7]. Keeping in view the above facts, the present study was undertaken.

MATERIAL AND METHODS

The experiment was conducted at Mountain Livestock Research Institute (MLRI) Manasbal, SKUAST-Kashmir during *Kharif*2014. The site is situated between 34.15^{o}N and 74.40^{o}E at an altitude of 1650

metres above mean sea level. Climatically the experimental site falls in temperate zone of north western Himalaya characterised by hot summers and very cold winters. The average annual precipitation is 944.6 mm (average of past 30 years) most of which is received from December to April in the form of snow and rains. It is evident from the data that mean maximum and minimum temperatures were 28.14^{o}C and 12.88^{o}C, respectively and the total precipitation amounted to 389.50 mm during crop growth period of 2014. The total number of sunshine hours recorded during the crop growth period was 144.36 hours and the mean maximum and minimum relative humidity were 79.30% and 53.00%, respectively during the crop growth period. The soil was clay loam in texture, high in organic carbon, low in available nitrogen, medium in available phosphorus and high in available potassium with neutral pH.

The experiment consisting of eleven treatments was laid out in a randomized complete block design with three replications and eleven treatments: Farmers practice (W_1), Earthing up and weeding at 30 DAS and 45 DAS (W_2), Atrazine @ 1.5 kg *a.i*ha^{-1} Pre-emergence at 1 DAS (W_3), Atrazine @ 1.5 kg *a.i*ha^{-1} Early Post-emergence at 10 DAS (W_4), Straw mulch (paddy straw) at 1DAS (W_5), Straw mulch (brown sarson) at 1DAS (W_6), Polyethylene mulch (black) at 1DAS (W_7), Polyethylene mulch (white) at 1DAS (W_8), Saw mulch at 1DAS (W_9), Weedy check (W_{10}) and Weed free (W_{11}). The variety HM-4 was used for the experiment. The gross plot size was 6 m × 3 m and net plot size was 5.40 m × 1.50 m.

Total number of young cobs of 10 randomly marked plants in each plot were counted before picking and then averaged as number of young cobs plant^{-1}. From the count of young cob in each plot after picking, the length of 10 randomly selected cobs with and without husk was measured with meter scale and averaged as young cob length with and without husk. It was expressed in centimeters. Ten randomly selected cobs in each plot used for measurement of length were also used for measurement of diameter. The diameter was measured with VernierCallipers. The diameter was expressed in millimeters. The young cobs used for measurement of length and diameter were weighed and the weight was averaged as weight of young cob. It was expressed in grams per cob. The cumulative weight of young cobs with and without husk from each net plot in all the pickings was taken in kilogram and then expressed as q ha^{-1}. The cumulative weight of husk and baby corn from each net plot in all picking was worked out separately. This weight of baby corn was divided with weight of husk and then expressed as husk baby corn ratio.The green fodder harvested from each net plot after completion of pickings was tied in bundles and weighed in kg plot^{-1}. The weight was converted into q ha^{-1}. Husk obtained was also included in fodder yield.

RESULTS

Yield attributing characters

Number of young cobs plant^{-1}

Weed management practices had a significant affect on number of young cobs plant^{-1} (Table 1). It was found that highest number of young cobs plant^{-1} (2.83) was recorded in weed free treatment whereas the lowest number of young cobs plant^{-1} (1.56) was recorded by weedy check. Earthing up and weeding at 30 DAS and 45 DAS (2.63) was on par with black polyethylene mulch (2.53) and white polyethylene mulch (2.45). Brown sarson mulch (2.36), paddy straw mulch (2.34), saw mulch (2.22), farmers' practice (2.15), atrazine @ 1.5 kg *a.i*. ha^{-1} pre-emergence (1.98), and atrazine @ 1.5 kg *a.i*. ha^{-1} early post-emergence (1.87) were on par with each other. White polyethylene mulch (2.45), brown sarson mulch (2.36) and paddy straw mulch (2.34) were on par with each other with respect to number of young cobs plant^{-1}.

Cob length with husk

Data presented in Table 1 showed that cob length with husk was significantly affected by different weed management practices. Weed free treatment recorded highest cob length with husk (19.31 cm). Earthing up and weeding at 30 DAS and 45 DAS recorded a value of 17.95 cm being on par with black polyethylene mulch (17.72 cm), white polyethylene mulch (17.38 cm), brown sarson mulch (17.31 cm) and paddy straw mulch (17.20 cm) whereas, the lowest cob length with husk (14.90 cm) was recorded by weedy check being on par with saw mulch (16.98 cm), farmers practice (16.94 cm), atrazine @ 1.5 kg *a.i*. ha^{-1} pre-emergence (16.79 cm), and atrazine @ 1.5 kg *a.i*. ha^{-1} early post-emergence (16.35 cm). Saw mulch was on par with white polyethylene mulch (17.38 cm), brown sarson mulch (17.31 cm) and paddy straw mulch (17.20 cm) with respect to cob length with husk.

Cob length without husk

A perusal of data in Table 12showed that cob length without husk was significantly affected by different weed management practices. Weed free treatment recorded highest cob length without husk (11.14 cm) being on par with earthing up and weeding at 30 DAS and 45 DAS with a value of 10.01 cm. Black polyethylene mulch (9.47 cm) being on par with white polyethylene mulch (9.35 cm), brown sarson mulch (9.23 cm) was followed by paddy straw mulch (9.04 cm) and saw mulch (8.62 cm). Lowest cob length without husk (6.22 cm) was recorded by weedy check being on par with farmers practice (8.48 cm), atrazine @ 1.5 kg *a.i*. ha^{-1}pre-emergence (8.29 cm), and atrazine @ 1.5 kg *a.i*. ha^{-1} early post-

emergence (8.25 cm). However, white polyethylene mulch (9.35 cm), brown sarson mulch (9.23 cm) and paddy straw mulch (9.04 cm) were on par with each other but showed significant variation when compared with saw mulch (8.62 cm).

Cob girth with husk

Cob girth with husk was significantly affected by different weed management practices as depicted in Table 12Weed free treatment recorded highest cob girth with husk (47.55 mm) being on par with earthing up and weeding at 30 DAS and 45 DAS which recorded a value of 46.36 mm was followed by black polyethylene mulch (44.46 mm), white polyethylene mulch (43.65 mm), brown sarson mulch (43.26 mm), paddy straw mulch (40.89 mm) and saw mulch (40.66 mm) and farmers practice (39.64 mm) in the decreasing order. Whereas, the lowest cob girth with husk (37.02 mm) was recorded by weedy check being on par with atrazine @ 1.5 kg *a.i*. ha^{-1} pre-emergence (37.95 mm), and atrazine @ 1.5 kg *a.i*. ha^{-1} early post-emergence (37.78 mm). Black polyethylene mulch (44.46 mm), white polyethylene mulch (43.65 mm), and brown sarson mulch (43.26 mm) were on par with each other. Paddy straw mulch (40.89 mm), saw mulch (40.66 mm) and farmers practice (39.64 mm) though significantly inferior than other mulches but were on par with each other.

Cob girth without husk

The results presented in Table 12 showed that cob girth without husk was significantly affected by different weed management practices. Weed free treatment recorded highest cob girth without husk (37.66 mm). Earthing up and weeding at 30 DAS and 45 DAS which recorded a value of 34.48 mm was on par with black polyethylene mulch (33.87 mm) and white polyethylene mulch (33.07 mm) whereas, the lowest cob girth without husk (26.21 mm) was recorded by weedy check that showed significant variation with respect to atrazine @ 1.5 kg *a.i*. ha^{-1} pre-emergence (30.05 mm), and atrazine @ 1.5 kg *a.i*. ha^{-1} early post-emergence (28.73 mm). Black polyethylene mulch (33.87 mm), white polyethylene mulch (33.07 mm), brown sarson mulch (32.59 mm) and paddy straw mulch (32.09 mm) were on par with each other and significantly superior than saw mulch (30.73 mm) and farmers practice (30.14 mm).

Cob weight with husk

Data presented in Table 12 showed that cob weight with husk was significantly affected by different weed management practices. Weed free treatment recorded highest cob weight with husk (36.29 g). Earthing up and weeding at 30 DAS and 45 DAS which recorded a value of 35.80 g being on par with black polyethylene mulch (35.44 g) showed significant variation with respect to white polyethylene mulch (35.02 g), brown sarson mulch (34.91 g), paddy straw mulch (34.38 g) and saw mulch (33.47 g), whereas, the lowest cob weight with husk (31.07 g) was recorded by weedy check. Farmers practice (32.35 g), atrazine @ 1.5 kg *a.i*. ha^{-1} pre-emergence (32.18 g), and atrazine @ 1.5 kg *a.i*. ha^{-1} early post-emergence (32.01) were on par with each other. Black polyethylene mulch (35.44 g) though on par with white polyethylene mulch (35.02 g) showed significant variation when compared with brown sarson mulch (34.91 g), paddy straw mulch (34.38 g) and saw mulch (33.47 g).

Cob weight without husk

A perusal of data in Table 12 showed that cob weight without husk was significantly affected by different weed management practices. Weed free treatment recorded highest cob weight without husk (10.87 g) being on par with earthing up and weeding at 30 DAS and 45 DAS which recorded a value of 9.63 g. Lowest cob weight without husk (8.08 g) was recorded by weedy check being on par with atrazine @ 1.5 kg *a.i*. ha^{-1} pre-emergence (8.17 g), and atrazine @ 1.5 kg *a.i*. ha^{-1} early post-emergence (8.22 g). Black polyethylene mulch (9.48 g) and white polyethylene mulch (9.27 g) though on par with each other were significantly superior when compared with brown sarson mulch (9.01 g), paddy straw mulch (8.86 g), saw mulch (8.59 g) and farmers practice (8.45 g)

Baby corn yield

Cob yield with husk

Data indicated that young cob yield with husk was influenced significantly by different weed management practices (Table 2). The results showed that highest cob yield (102.55 q ha^{-1}) with husk was recorded by weed free treatment, whereas, the lowest cob yield (73.90 q ha^{-1}) with husk was recorded by weedy check. Earthing up and weeding at 30 DAS and 45 DAS with cob yield of 98.59 q ha^{-1} with husk was on par with black polyethylene mulch (97.81 q ha^{-1}), white polyethylene mulch (97.08 q ha^{-1}), brown sarson mulch (96.83 q ha^{-1}) and paddy straw mulch (96.81 q ha^{-1}) and was followed by saw mulch (92.17 q ha^{-1}), farmers practice (91.36 q ha^{-1}), atrazine @ 1.5 kg *a.i*. ha^{-1} pre-emergence (88.04 q ha^{-1}), and atrazine @ 1.5 kg *a.i*. ha^{-1} early post-emergence (87.53 q ha^{-1}).

Cob yield without husk

Observations presented in Table 2 revealed that cob yield without husk was influenced significantly by different weed management practices. The results showed that highest cob yield (20.09 q ha^{-1}) without husk was recorded with weed free treatment being on par with earthing up and weeding at 30 DAS and

45 DAS (19.46 q ha^{-1}), black polyethylene mulch (19.34 q ha^{-1}) but significantly higher than white polyethylene mulch (19.03 q ha^{-1}), brown sarson mulch (18.19 q ha^{-1}), paddy straw mulch (18.04 q ha^{-1}), saw mulch (17.41 q ha^{-1}), farmers practice (17.26 q ha^{-1}), atrazine @ 1.5 kg *a.i.* ha^{-1} pre-emergence (16.62 q ha^{-1}), and atrazine @ 1.5 kg *a.i.* ha^{-1} early post-emergence (15.36 q ha^{-1}). Lowest cob yield (13.60 q ha^{-1}) without husk was recorded by weedy check. Brown sarson mulch (18.19 q ha^{-1}), paddy straw mulch (18.04 q ha^{-1}), and saw mulch (17.41 q ha^{-1}) were on par with each other. Black polyethylene mulch (19.34 q ha^{-1}) and white polyethylene mulch (19.03 q ha^{-1}) though on par with each other were significantly superior than other mulches.

Table 1: Effect of weed management practices on cob girth with and without husk(mm), cob weight with and without husk(g), cob length with and without husk(cm) , cobs per plant of baby corn (*Zea mays* L.)

Biological yield ---------- Treatments	Cob girth with husk (mm)	Cob girth without husk (mm)	Cob weight with husk (g)	Cob weight without husk (g)	Cob length with husk (cm)	Cob length without husk (cm)	Cobs per plant
Farmers practice	39.64	30.14	32.35	8.45	16.94	8.48	2.15
Earthing up and weeding	46.36	34.48	35.80	9.63	17.95	10.01	2.63
Atrazine @ 1.5 kg a.i ha^{-1} PE	37.95	30.05	32.18	8.22	16.79	8.29	1.98
Atrazine @1.5 kg a.i ha^{-1} Early PoE	37.78	28.73	32.01	8.17	16.35	8.25	1.87
Paddy straw mulch	40.89	32.09	34.38	8.86	17.20	9.04	2.34
Brown sarson mulch	43.26	32.59	34.91	9.01	17.31	9.23	2.36
Black polyethylene mulch	44.46	33.87	35.44	9.48	17.72	9.47	2.53
White polyethylene mulch	43.65	33.07	35.02	9.27	17.38	9.35	2.45
Saw mulch	40.66	30.73	33.47	8.59	16.98	8.62	2.22
Weedy check	37.02	26.21	31.07	8.08	14.90	6.22	1.56
Weed free	47.55	37.66	36.29	9.87	19.31	11.14	2.83
SEm±	0.56	0.46	0.13	0.12	0.22	0.11	0.06
C.D (p≤0.05)	1.65	1.38	0.34	0.33	0.67	0.34	0.18

Table 2:Effect of weed management practices on cob yield with and without husk (q ha^{-1}), husk baby corn ratio and green fodder yield (q ha^{-1}) of baby corn (*Zea mays* L.)

Treatments	Cob yield with husk (q ha^{-1})	Cob yield without husk (q ha^{-1})	Green fodder yield (q ha^{-1})
Farmers practice	91.36	17.26	323.64
Earthingup and weeding	98.59	19.46	345.73
Atrazine @ 1.5 kg a.i ha^{-1} PE	88.04	16.62	319.60
Atrazine @1.5 kg a.i ha^{-1} Early PoE	87.53	15.36	311.54
Paddy straw mulch	96.61	18.04	329.83
Brown sarson mulch	96.83	18.19	330.51
Black polyethylene mulch	97.81	19.24	338.20
White polyethylene mulch	97.08	19.03	336.95
Saw mulch	92.17	17.41	328.07
Weedy check	73.90	13.60	290.99
Weed free	102.55	20.09	355.26
SEm±	0.88	0.27	6.02
C.D (p≤0.05)	2.61	0.80	18.24

Green fodder yield

Table 2 indicated that the green fodder yield (straw, husk and by products of young cobs) of baby corn was significantly influenced by different weed management practices. Significantly highest green fodder yield (355.26 q ha^{-1}) was recorded by weed free treatment being on par with earthing up and weeding at 30 DAS and 45 DAS (345.73 q ha^{-1}) and black polyethylene mulch (338.20 q ha^{-1}) and showed significant variation with respect to white polyethylene mulch (336.95 q ha^{-1}), brown sarson mulch (330.51 q ha^{-1}), paddy straw mulch (329.83 q ha^{-1}), saw mulch (328.07 q ha^{-1}), farmers practice (323.64 q ha^{-1}), atrazine @ 1.5 kg *a.i.* ha^{-1} pre-emergence (319.60 q ha^{-1}), and atrazine @ 1.5 kg *a.i.* ha^{-1} early post-emergence

(311.54 q ha^{-1}) in decreasing order. Lowest green fodder yield (290.99 q ha^{-1}) was recorded by weedy check. Black polyethylene mulch (338.20 q ha^{-1}), white polyethylene mulch (336.95 q ha^{-1}), brown sarson mulch (330.51 q ha^{-1}), paddy straw mulch (329.83 q ha^{-1}) and saw mulch (328.07 q ha^{-1}) were on par with each other.

DISCUSSION

Yield contributing characters *viz*. number of cobs $plant^{-1}$, cob length with and without husk, cob girth with and without husk, and cob weight with and without husk, varied significantly amongst different weed management practices. It was found that various yield attributing parameters were significantly higher in weed free treatment followed by earthing up and weeding at 30 DAS and 45 DAS whereas, lowest value of yield contributing characters were recorded in weedy check (Table 1) [3]. Maximum yield contributing characters were recorded under weed-free treatment, and they were significantly superior to that under weedy check (Table 1) [5]. Highest baby corn yield with and without husk, green fodder yield with husk and without husk were significantly higher in weed free treatment whereas lowest value was observed in weedy check (Table 2). The improved yield contributing characters under these treatments might be due to continuous removal of weeds under weed free treatment which might have maintained high soil fertility status and moisture content by means of less removal of plant nutrients and moisture by weeds [4]The highest baby corn yield and green fodder yield were recorded under weed free treatment (Table 2) [6].

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