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Response of Baby Corn (*Zea mays* L.) to Different Weed Management Practices and Zinc Fertilization

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ABSTRACT

A field experiment was conducted during *kharif* season of 2014. The treatment comprises of five weed management practices viz., weedy check, two hand weeding (20 and 40 DAS), pendimethalin @ 1 kg ha^{-1}, pendimethalin @ 1 kg ha^{-1}+ one HW (20 DAS) and pendimethalin @ 1 kg ha^{-1}+ Glyphosate @2.5 l ha^{-1} (20 DAS) and three levels of zinc fertilizer viz.,zinc @ 5, 10 and 15 kg ha^{-1} laid out in a factorial Randomized Block Design with three replications. The results showed that two hand weeding significantly increased growth attributes and finally baby corn yield. While, among the herbicides, pendimethalin @ 1 kg ha^{-1}+ one HW (20 DAS) gave the highest baby corn yield and green fodder yield followed by pendimethalin @ 1 kg ha^{-1}+ Glyphosate @ 2.5 l ha^{-1} (20 DAS) and pendimethalin @ 1 kg ha^{-1}. From the present experiment, it was revealed that two hand weeding (20 and 40 DAS) was found most suitable weed management practices with highest B:C ratio. Among, the herbicides pendimethalin @ 1 kg ha^{-1} + Glyphosate @ 2.5 l ha^{-1} (20 DAS) gave the highest value of B : C ratio followed by pendimethalin @ 1 kg ha^{-1} + one HW (20 DAS). Among, the zinc levels, 15 kg ha^{-1} produced the highest corn yield and B : C ratio followed by zinc @ 10 kg ha^{-1}.

Keywords Baby corn, Economics, Glyphosate, Pendimethalin, Zinc.

INTRODUCTION

Infant corn has picked up ubiquity as esteemed vegetable all through the world remembering for India. Cobs evacuated inside 3-5 days after their development are called baby corns. Development practices of baby corn are like that suggested for ordinary corn creation with just special case is the span of the yield, which is rough 60 days as thought about as 110–120 days if there should arise an occurrence of grain crop. Farmers usually give prime importance to few cultural practices and neglect other factors like micronutrient and weed control. As maize is usually grown during the hot summer (April- May) in Nagaland when manual method of weed control is difficult to imply because of unavailability of labor and high wages during season. Further, wide space of maize, allows fast growth of variety of weed species causing a considerable reduction in yield. Under such situations, farmers may use different pre- and post-emergence herbicides to control annual grass and broad-leaved weeds effectively in maize. Weed management strategies attempt to limit the deleterious effects of weeds growing with crop plants. These effects could be quite

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variable, but the most common is competition for available resources. The quantities of growth factors used by weeds are thus unavailable to the crop. On the other hand, the perennial weeds like *Cyperus rotundus* and *Cynodon dactylon* which are among the worst weeds of the world infest the maize crop and thus increase the cost of production, as hand weeding is not effective against these weeds.

Like major plant nutrients, zinc deficiency is severe problem in soils of India,which is a key factor for poor yield. It is an established fact that among field crops, maize is the most susceptible to zinc deficiency and can be used as an indicator plant of zinc deficiency. In zinc deficient plants chlorotic spots are seen at the base of the leaves become white, symptoms called 'white bud of maize'. The deficiency of zinc in plants at later stages of growth can be corrected by foliar application of zinc sulfate (5% $ZnSO_4$ + 2.5% hydrated lime) dissolve in water.

MATERIALS AND METHODS

A field experiment was carried out in the experimental research farm of School of Agricultural Sciences and Rural Development (SASRD), Nagaland University campus, Medziphema during the *kharif* season, 2014. The research plot was located at an altitude of 310 meters above mean sea level with the geographical location at 25^0 45/ 43// North latitude and 95^0 53/ 4// East longitude. The soil of the experimental field was sandy loam in texture, well drained, acidic in reaction (pH 4.6), low in organic carbon (0.33%), medium in available N (351.22 kg ha^{-1}) as well as medium in available P (19.23 kg ha^{-1}) and high in available K (330.56 kg ha^{-1}). The treatments were arranged in Randomized Block Design with three replications and 15 treatments combination. The factors comprised of five weed management practices viz., weedy check, two hand weeding (20 and 40 DAS), pendimethalin @ 1 kg ha^{-1}, pendimethalin @ 1 kg ha^{-1} + one HW (20 DAS) and pendimethalin @ 1 kg ha^{-1} + Glyphosate @ 2.5 L ha^{-1} (20 DAS) and three zinc fertilizer doses viz., zinc @ 5 kg ha^{-1}, zinc @ 10 kg ha^{-1} and zinc @ 15 kg ha^{-1}. Each plot received identical cultural treatments in terms of ploughing, cultivation, seed rate and disease control. Sowing of baby corn hybrid variety HM-4 was done on 17^{th} June, 2014 by using seed rate 25 kg ha^{-1} in the rows 50 cm apart. A uniform dose of 80 kg ha^{-1} N, 40 kg ha^{-1} P_2O_5 and 30 kg ha^{-1} K_2O was applied in all the plots. Fifty percent of N and full quantity of P_2O_5 and K_2O were applied just before the sowing as basal application. The remaining nitrogen was top dressed at 25 DAS. Zinc sulfate was applied treatment wise in the respective plot @ 5, 10 and 15 kg ha^{-1} at the time of sowing. Various observations were recorded on weed parameters and crop parameters. The weed count and dry weight of weeds were recorded at 20, 40 DAS and at harvest and transformed values were statistically analyzed.

RESULTS AND DISCUSSION

The experimental field was infested with 14 weed species comprising of broad leaf weeds, grasses and sedges. The predominant weed species were *Ageratum conyzoides* (L.) *Borreria hispida* (L.) *Oxalis corniculata* (L.), *Mimosa pudica* (L.), *Amaranthusviridis* (L.), *Commelina benghalensis*, *Chromolaenaodorata* in broad leaf weeds. *Digitaria sanguinalis* (L.), *Cynodon dactylon* (L.), *Setaria glauca* (L.), *Imperata cylindrica* (L.) and *Eleusine indica* (L.) in grassy weeds and *Cyperus rotundus* (L.) and *Cyperus iria* (L.) in sedge weeds.

Effect of weed management practices on weed flora

Weed management practices significantly influenced the weed density and weed dry weight at 20, 40 DAS and at harvest stage (Table 1). In weedy check, the total weed population was significantly higher than all the other treatments. Density of broad leaf weeds, sedge weeds and grassy weeds were minimum under two hand weeding done at 20 and 40 DAS. Among the herbicides, pendimethalin @ 1 kg ha^{-1} + one HW (20 DAS) controlled most of the associated weeds which was closely followed by pendimethalin @ 1 kg ha^{-1} + Glyphosate 2.5 L ha^{-1}. Weedy check recorded the highest weed biomass at all stages and it had reduced significantly when

Table 1. Effect of weed management practices and zinc fertilizationon weed parameters at 60 DAS. Figures in the parentheses are the original values.

Treatments	Total weed population (no.m^{-2})		Weed dry matter accumulation (g m^{-2})		Weed index (%)		WCE (%)	
Weed management practices								
W_1- Weedy check	13.70	(187.26)	8.19	(66.55)	61.81		0.00	
W_2- Hand weeding at 20 and 40 DAS	5.12	(25.68)	0.76	(0.08)	0.00		99.87	
W_3- Pendimethalin @ 1kg ha^{-1}	14.00	(195.43)	7.49	(55.54)	30.00		16.54	
W_4- Pendimethalin @ 1 kg ha^{-1}+1 HW @ 20 DAS	9.50	(89.76)	1.19	(0.91)	15.45		98.63	
W_5- Pendimethalin @ 1 kg ha^{-1} + Glyphosate @ 2.5 L ha^{-1} at 20 DAS	12.11	(146.10)	1.93	(3.24)	23.63		95.13	
SEm ±	0.32		0.10		–		–	
LSD (p=0.05)	0.93		0.28		–		–	
Zinc levels (kg ha^{-1})								
Z_1- 5	11.22	(125.38)	3.86	(14.37)	4.55	(20.18)	4.88	(23.35)
Z_2- 10	10.67	(113.37)	4.09	(16.23)	4.36	(18.50)	4.90	(23.46)
Z_3- 15	10.76	(115.36)	3.79	(13.84)	4.11	(16.39)	4.78	(22.35)
SEm ±	0.25		0.07		0.25		0.48	
LSD (p=0.05)	NS		0.21		NS		NS	

weeds were controlled either by use of herbicides or hand weeding (20 and 40 DAS). The lowest weed biomass was recorded under hand weeding (20 and 40 DAS) followed by pendimethalin @ 1 kg ha^{-1} + one HW (20 DAS), pendimethalin @ 1 kg ha^{-1} + Glyphosate 2.5 L ha^{-1} and pendimethalin @ 1 kg ha^{-1}. These results are in accordance with Sarma and Gautam (2010). The highest weed control efficiency (99.87%) was recorded with two hand weeding (20 and 40 DAS) followed by pendimethalin @ 1 kg ha^{-1} + 1 hand weeding (20 DAS). Maximum yield loss of 61.81% was recorded under weedy check where, weeds were not controlled in the entire crop season. Sanodiya *et al.* (2013) also reported two hand weeding (20 and 40 DAS) as an effective method of weed control for achieving the maximum yield. Maximum yield loss of 49.5% was recorded under weedy check.

Effects of weed management practices on crop growth and yield

Plant height (cm), number of green leaves plant^{-1}, dry matter accumulation (g plant^{-1}), leaf area index (LAI) recorded highest under two hand weeding (Table 2). Among the herbicides, it was recorded with pendimethalin @ 1 kg ha^{-1} + one HW (20 DAS) which was closely followed by pendimethalin @ 1 kg ha^{-1} + Glyphosate 2.5 L ha^{-1}. The fastest initiation of baby cob was obtained with two hand weeding (20 and 40 DAS). Number of baby cobs plant^{-1} was significantly influenced by different weed management practices. The number of baby cobs was found higher with all the different treatments over weedy check. The maximum length, girth and fresh weight of baby corn were also recorded with two hand weeding (20 and 40 DAS). Further interculturing withtwo hand weeding (20 and 40 DAS) registered higher baby corn yield (1.10 t ha^{-1}), baby cob yield (5.20 t ha^{-1}) and green fodder yield (30.83 t ha^{-1}) followed by pendimethalin @ 1 kg ha^{-1} + one HW (20 DAS) which was closely followed by pendimethalin @ 1 kg ha^{-1} + Glyphosate 2.5 L ha^{-1}. Sarma and Gautam (2010) also reported that maximum grain and biological yields were recorded with two hand weeding at 25 and 45 DAS. The highest benefit cost ratio (3.66) was achieved under two hand weeding (20 and 40 DAS). While among the herbicides pendimethalin @

Table 2. Effect of weed management practices and zinc fertilization on growth attributes, yield attributes and economics of baby corn.

Treatments	Plant height (cm)	Dry matter accu-mu-lation (g pl-ant^{-1})	Leaf area index (LAI)	Len-gth (cm)	Girth (cm)	Days to initia-tion of baby cob	Baby corn yield (t ha^{-1})	Baby cob yield (t ha^{-1})	Green fod-der yield (t ha^{-1})	Net return (×10$^{3'}$ ha^{-1})	Bene-fit : Cost ratio
Weed management practices											
W_1- Weedy check	122.48	35.00	2.83	7.36	0.94	57.06	0.42	2.54	8.37	16.97	1.67
W_2- Hand wee-ding at 20 and 40 DAS	199.59	94.55	4.58	8.48	1.24	49.32	1.10	5.20	30.83	86.64	3.66
W_3- Pendimetha-lin @ 1 kg ha^{-1}	161.63	56.53	3.53	8.09	1.05	52.85	0.77	3.59	19.23	55.17	3.18
W_4- Pendimetha-lin @ 1kg ha^{-1} + 1 HW @ 20 DAS	179.74	82.39	3.83	8.36	1.16	50.59	0.93	4.40	25.55	70.60	3.43
W_5- Pendimetha-lin @ 1kg ha^{-1} + Glyphosate @ 2.5 L ha^{-1} at 20 DAS	170.63	68.13	3.72	8.24	1.11	51.03	8.04	3.96	23.62	64.58	3.45
SEm ±	3.61	2.44	0.11	0.18	0.02	1.06	0.03	0.10	0.72	-	-
LSD (p=0.05)	10.45	7.08	0.33	0.53	0.07	3.08	0.08	0.29	2.10	-	-
Zinc levels (kg ha^{-1})											
Z_1- 5	156.78	60.84	3.28	7.79	1.07	53.29	0.75	3.67	20.11	54.82	3.16
Z_2- 10	167	67.33	3.70	8.19	1.10	52.13	0.80	3.91	21.52	59.94	3.34
Z_3- 15	176.66	73.79	4.11	8.34	1.14	51.09	0.88	4.23	22.93	67.46	3.60
SEm ±	2.80	1.89	0.09	0.14	0.02	0.82	0.20	0.08	0.56	-	-
LSD (p=0.05)	8.10	5.48	0.25	0.41	0.05	NS	0.06	0.23	1.63	-	-

1 kg ha^{-1} + Glyphosate 2.5 L ha^{-1} recorded the highest benefit cost ratio (3.45) which was closely followed by pendimethalin @ 1 kg ha^{-1} + one HW (20 DAS) (3.43). These results are in agreement with Kumar *et al.* (2012) who reported that baby corn can be grown profitably with two hand weeding at 20 and 40 DAS. Sarma and Gautam (2010) also reported that two hand weedings at 25 and 45 DAS recorded the highest net return (`18,155 ha^{-1}) and B : C ratio (1.62) as compared to rest of the weed control method.

Effects of zinc fertilization on crop growth and yield

The highest plant height, number of green leaves plant^{-1}, dry matter accumulation (g plant^{-1}) and leaf area index (LAI) were recorded with the application of Zinc @ 15 kg ha^{-1} (Table 2). The higher plant height, number of green leaves plant^{-1} and dry matter accumulation (g plant^{-1}) may be attributed to better availability of zinc at higher levels of its application, whereas, increase in LAI might be due to more number of leaves and leaf area per plant. Mahdi *et al.* (2012) also noticed an increase in all the growth attributes of maize with higher levels of zinc application up to 5 kg Zn ha^{-1} at Udaipur, Rajasthan (India). The maximum length, girth and fresh weight of baby corn was recorded with application of zinc @ 15 kg ha^{-1}. Further baby corn yield (1.10 t ha^{-1}), baby cob yield (5.20 t ha^{-1}) as well as green fodder yield (30.83 t ha^{-1}) increased significantly with increase in level of zinc up to 15 kg ha^{-1}.

Similar results was also reported by Kumar and Bohra (2014) who revealed that compared to control, application of 5 and 10 kg Zn ha^{-1} improved baby corn yield, baby cob yield and green fodder yield. This might be due to the enhanced translocation of photosynthates with applied zinc, which resulted in higher production of green fodder in the respective levels of nutrient. Similar lines have been reported in maize of significantly higher grain yield with the application of higher levels of zinc up to 5 kg Zn ha^{-1} by Meena *et al.* (2013). Ashoka *et al.* (2009), Arvadiya *et al.* (2012), Barlog *et al.* (2008), Barod *et al.* (2012) also revealed that application of RDF + 25 kg $ZnSO_4$+10 kg $FeSO_4$+35 kg vermicompost recorded significantly higher yield of baby corn (64.43 q ha^{-1}). The highest cost benefit : ratio (3.60) was achieved under application of zinc @ 15 kg ha^{-1}. This finding was in agreement with Kumar and Bohra (2014) who reported that application of zinc up to 10 kg Zn ha^{-1} registered significantly maximum gross return, net return and benefit cost ratio over control. Similar lines of results were also reported by Mahdi *et al.* (2012).

Two hand weeding (20 and 40 DAS) and zinc dose of 15 kg ha^{-1} gave the highest gross return, the highest net return and also the highest benefit cost. Among the herbicides pendimethalin @ 1 kg ha^{-1} + Glyphosate 2.5 L ha^{-1} gave the highest benefit cost ratio followed by pendimethalin @ 1 kg ha^{-1} +1 hand weeding at 20 DAS.

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