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Influence of Sowing Dates and Zinc Levels on Growth and Yield of Summer Pearl Millet (*Pennisetum glaucum* L.)

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ABSTRACT: A field investigation was conducted at Central Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj, (U.P.) during *Zaid*-2020. The soil of test site was sandy top soil in surface, almost neutral in pH. The investigation was laid out in randomized block design with nine treatments consisted of Zinc *viz.*, Z_1 (15 kg ha^{-1}), Z_2 (20 kg ha^{-1}), Z_3 (25 kg ha^{-1}) and sowing dates *viz.*, D_1 (Sowing on April 24), D_2 (Sowing on May 02), D_3 (Sowing on May 11) which were replicated thrice and effect was observed on summer Pearl Millet. The result shown significantly higher plant height (215.97 cm), Dry weight (110.87 g), Crop Growth Rate (13.81 g/m^2/day), Leaf area (2442.07 cm^2), Leaf area index (6.11), number of leaves $plant^{-1}$ (15.9), number of Effective tillers/plant (3.60), Test weight (7.73 g), Grain yield (2.42 t/ha), Stover yield (7.62), Harvest index (24.10) was recorded with sowing date of May, 11 along with the application of 25 kg/ha Zinc.

Keywords: Sowing dates, Zinc, Pearl Millet, Yield

INTRODUCTION

Pearl millet (*Pennisetum glaucum* L.) is multipurpose cereal crop belongs to the Poaceae family. It is commonly called as Bajra, Bajri, Sajje, Kambu, Kamban, Sajjaluetc in variour Indian local languages. It is commonly used for food, feed, and forages purpose. Pearl millet, a tropical cereal and the world's most drought-resistant crop, is widely farmed throughout the world's dry and semi-arid regions (Fageria, 1992). Pearl millet is one of the most heat and drought tolerant cereals, as well as tolerant to saline and acid soils, and is easy to cultivate in dry places where rainfall is insufficient for maize or even sorghum (FAO, 2004). India produces over half of the world's pearl millet, accounting for 42% of global output (FAO, 2006). The fibre and most vitamins are low in pearl millet, although it is high in vitamin A. (NRC, 1996; DeVries and Toenniessen, 2001). Pearl millet is grown on 7.8 million hectares in India, with a yield of 9.25 million tonnes and a productivity of 1270 kg per hectare (Anonymous, 2016). Rajasthan, Maharashtra, Gujarat, Uttar Pradesh, and Haryana are the primary pearl millet farming states, accounting for more than 90% of the country's pearl millet acreage (Yadav, 2011).

Pearl millet planting time recommendations are frequently depending on the calendar day or soil temperature (Andrews *et al.,* 1998). The delay in seeding resulted in lower results for all metrics (Iping, 1997). Yield may be boosted by identifying higher producing cultivars and planting at the right time (Khan *et al.,* 2009 and Arif *et al.,* 2001). The millet sowing date for direct planting has a big impact on how fast it grows and how much it yields (Farrell *et al.,* 2003). Planting crops on time allows for adequate root development and vegetative growth, allowing for the most efficient use of available soil nutrients and radiant energy (Soler *et al.,* 2007).

Zinc is required for plant development and reproduction to be normal and healthy (Marschner, 1995). Grain crop panicle growth and maturity are slowed by zinc deficiency in the plant (Alloway, 2004). Zinc is a necessary component for crop production and plant development (Ali *et al.,* 2008; Graham *et al.,* 2000). It increases growth hormone biosynthesis, starch creation, and grain production and maturation (Brady and Weil, 2002). There has not been much research done on summer Pearl Millet, therefore sowing date and Zinc level in summer Pearl Millet in the Prayagraj conditions is still very much uncertain. Keeping this point in view, an experiment was conducted to find out suitable date of sowing and Zinc level for maximizing yield of summer Pearl Millet under eastern U.P. condition.

MATERIALS AND METHODS

The investigation was conducted during the *Zaid* season of 2020 at the Crop Research Farm, Department of

Agronomy, Sam Higginbottom University of Agriculture, Technology and Science (SHUATS), Prayagraj (U.P.). The Crop Research Farm is situated at 25.57^{o} N latitude, 87.19^{o} E longitude and at an altitude of 98m above mean sea level. The investigation was laid out in Randomized block design, which was replicated three times. The treatment comprised of three sowing dates noted as D_1 (Sowing on April 24), D_2 (Sowing on May 02) and D_3 (Sowing on May 11) and three Zinc levels Z_1 (15 kg/ha Zinc), Z_2 (20 kg/ha Zinc), Z_3 (25 kg/ha Zinc) through surface application and the possible combinations. During the developing season, the mean week by week most extreme and least temperature, relative humidity and rainfall were 36.60^{o}C, 24.90^{o}C, 76.40 %, 48.48% and 4.72 mm, respectively. Sowing of Pearl millet was done at a spacing of 40 cm × 10 cm using seed rate of 5 kg ha^{-1}. The field was uniformly irrigated one day before sowing on each of the sowing dates. The RDF i.e. Nitrogen (60 kg ha^{-1}) was applied in the form of Urea in two split doses, first as basal and the remaining dose at 45 DAS, whereas full dose of Phosphorous (40 kg ha^{-1}) and full dose of Potassium (40 kg ha^{-1}) were applied through DAP and MOP. Zinc was applied in each plot according to the treatments before sowing of seed along with fertilizers during first split as basal. Observations on growth parameters, yield attributes and yield of pearl millet, was recorded and their significance was tested by the variance ratio and F-value at 5% level of significance (Gomez and Gomez, 1984).

Relative economics was calculated as per the prevailing market prices of the inputs and produced during *Zaid* season.

RESULT AND DISCUSSION

A. Growth parameters

Growth parameters of Pearl Millet, *viz.* plant height (cm), Dry weight (g), Crop Growth Rate (g/m^2/day), Leaf area (cm^2), Leaf Area Index (LAI), number of leaves/plant varied due to different sowing dates and Zinc level are presented in Table 1. The treatment in which sowing was done on May 11 along with the application of 25 kg/ha Zinc resulted in significantly highest plant height (215.97 cm), Dry weight (110.87 g), Crop Growth Rate (13.81 g/m^2/day), Leaf area (2442.07 cm^2), Leaf area index (6.11), number of leaves/plant (15.9). Zinc is an important element for the synthesis of tryptophan, which is the pioneer for the synthesis of IAA (Indole acetic acid) which is a growth hormone. Therefore in the presence of high level of zinc, growth attributes shown significant increase. Increase in growth parameters with May 11 sowing date might have represented congenial weather conditions like prolonged photoperiod, optimum temperatures and sufficient amount of moisture levels at vegetative growth. These results are in conformity with those of Jan *et al.* (2015), Maurya *et al.,* (2016), Jain *Pennisetum* (2001), Jakhar *et al.,* (2006) and Dalvi *et al.,* (2010).

B. Yield attributes

Yield attributes such as number of effective tillers plant^{-1}, Ear head length (cm.), test weight (g) exhibited significant variation during the experimental period due to different sowing dates and Zinc levels (Table 2). The yield attributing character number of effective tillers plant^{-1} and test weight (g) showed significant result for the sowing date of May 11 along with the application of 25 kg/ha Zinc while Ear-head length (cm) showed non-significant result among the treatments. Higher levels of Zinc along with the sowing date of May 11 gave higher yield attributes than those with lower Zinc levels and sowing dates of April 24 and May 02.). Zinc improved translocation of photosynthates towards reproductive system and thereby enhancing the yield of the crop. Better photosynthetic activity also may have resulted in better translocation of photosynthates from source to sink due to congenial weather conditions where optimum temperature and mean sunshine hours prevailed during crop growth, might have lead to higher yield attributes. These finding are similar to those reported by Prasad *et al.,* (2014), Choudhary *et al.,* (2005) and Jan *et al.,* (2015).

C. Yield

Grain and Stover yield varied considerably significant due to different sowing dates and application of Zinc at different levels (Table 2). Sowing date of May 11 along with the application of 25 kg/ha Zinc recorded significantly highest grain yield (2.42 t/ha) Stover yield (7.62) and Harvest Index (24.10 %). Zinc application might have increased the enzymatic activity which might have supported the translocation of assimilates towards the sink efficiently thereby resulting in increased yield. Higher grain yield and straw yield was also probably due to good seed set favoured by warm weather prevailed during maturity and due to ideal usage of solar radiation, temperature, higher assimilates production and its conversion to starch. Similar results were reported by Maurya *et al.* (2016) and Andhale *et al.* (2003).

Table 1: Influence of sowing dates and Zinc levels on Growth attributes of summer Pearl Millet.

Treatment	At Harvest					75DAS- At harvest	
	Plant Height (cm)	Dry weight (g plant^{-1})	No. of leaves/ Plant	Leaf area (cm^2)	Leaf area index	CGR (g/m^2/day^1)	RGR (g/g^1/day^1)
T1: Sowing on April 24 + 15 kg/ha Zn (Control)	195.03	90.40	12.5	1842.27	4.61	4.72	0.008
T2: Sowing on April 24 + 20 kg/ha Zn	201.50	95.83	14.2	2051.47	5.13	7.43	0.006
T3: Sowing on April 24 + 25 kg/ha Zn	207.13	105.77	15.1	2331.07	5.83	11.47	0.009
T4: Sowing on May 2 + 15 kg/ha Zn	192.70	91.40	12.0	1818.27	4.55	7.016	0.006
T5: Sowing on May 2 + 20 kg/ha Zn	201.20	95.07	14.1	2091.47	5.23	8.99	0.008
T6: Sowing on May 2 + 25 kg/ha Zn	214.53	104.23	15.0	2350.93	5.88	10.74	0.009
T7: Sowing on May 11 + 15 kg/ha Zn	196.37	93.60	11.9	1788.80	4.47	8.96	0.008
T8: Sowing on May 11 + 20 kg/haZn	205.60	100.37	14.5	2108.00	5.27	9.65	0.008
T9: Sowing on May 11 + 25 kg/ha Zn	215.97	110.87	15.9	2442.07	6.11	13.81	0.011
SEd(+)	2.7905	1.46	0.86	169.26	0.42	0.82	0.0002
CD.(5%)	5.91	3.10	1.83	358.81	0.90	1.73	-

Table 2: Influence of sowing dates and Zinc levels on yield attributes and yield of summer Pearl Millet.

Treatment	Yield attributes and yield					
	No. of effective tillers plant^{-1} (g)	Ear-head Length (g)	Test weight (g)	Grain yield (t/ha)	Stover yield (t/ha)	Harvest Index(%)
T1: Sowing on April 24 + 15 kg/ha Zn (Control)	1.60	26.93	6.50	1.56	6.04	20.52
T2: Sowing on April 24 + 20 kg/ha Zn	2.20	27.87	7.12	1.82	6.46	21.98
T3: Sowing on April 24 + 25 kg/ha Zn	2.90	29.33	7.48	2.25	7.24	23.70
T4: Sowing on May 2 + 15 kg/ha Zn	1.60	26.33	6.62	1.50	6.09	19.76
T5: Sowing on May 2 + 20 kg/ha Zn	2.30	27.77	7.29	1.93	6.49	22.92
T6: Sowing on May 2 + 25 kg/ha Zn	3.00	29.63	7.56	2.28	7.27	23.87
T7: Sowing on May 11 + 15 kg/ha Zn	1.70	27.53	6.67	1.62	6.14	20.87
T8: Sowing on May 11 + 20 kg/ha Zn	2.70	28.43	7.06	2.06	6.61	23.76
T9: Sowing on May 11 + 25 kg/ha Zn	3.60	29.50	7.73	2.42	7.62	24.10
S.E.d(+)	0.21	1.09	0.19	0.22	0.41	0.85
CD.(5%)	0.45	-	0.41	0.46	0.88	1.80

CONCLUSION

Pearl millet is often planted during the Kharif season, but it may also be planted during the Zaid season because it uses less water than other cereal crops. Sowing Pearl millet in mid-May with a 25 kg/ha Zinc treatment can be more advantageous than sowing in late April or May with 15 kg/ha or 20 kg/ha Zinc in the Prayagraj area of Uttar Pradesh for a larger yield during the late Zaid season. As there has not been much research done on summer Pearl Millet and different regions have different soils properties and climatic conditions, research can further be continued to know the exact sowing date and zinc level of that region.

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