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Effect of Integrated Nutrient Management on Growth Parameters of Baby Corn (*Zea mays* L.)

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Abstract: The present investigation entitled "Effect of integrated nutrient management on growth parameters of baby corn (Zea mays L.)" was carried out during Kharif season 2015 at the Instructional Dairy Farm (IDF), Nagla, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Udham Singh Nagar, Uttarakhand, India. The experimental design was Randomized Block Design with 11 treatments consisting of sole application of NPK fertilizer, sole application of Azotobacter and Azospirillum, and application of Azotobacter and Azospirillum along with NPK fertilizer. It was found that field emergence percent did not differ significantly with different integrated nutrient management practices, however significantly higher plant population was recorded at application of 100% NPK+Azot+Azos followed by 75% NPK+Azot+Azos though both were non-significant. Similarly tallest plants were recorded with application of 100% NPK+Azot+Azos followed by 75% NPK+Azot+Azos at 25 DAS as well as at harvest stage. Integrated nutrient management practices had significant effect on dry matter production too at all growth stages. Application of 75% NPK+Azot+Azos produced significantly higher dry matter at 25 DAS, however at 50 DAS and harvesting stage, significantly higher dry matter production was recorded with application of 100% NPK+Azot+Azos. Also the dry matter accumulation in baby corn, green fodder and total was affected significantly by different integrated nutrient management practices with value of each one being highest under application of 100% NPK+Azot+Azos. The study concluded the importance of integrated nutrient management practice for better growth and development of baby corn as higher dose of nitrogen coupled with biofertilizers, being an integrated nutrient application treatment, improved the plant growth and plant population leading to higher dry matter accumulation.

Keywords- integrated nutrient management; azotobacter; azospirillum; baby corn; dry matter accumulation.

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1. Introduction

Maize (*Zea mays* L.) is the most versatile crop having wider adaptability in varied ecologies. It is an important cereal crop for food, feed and fodder. It is a miracle crop with higest genetic yield potential among the cereals and also known as 'queen of cereals' **(Kanaan *et al.*, 2013).** Presently baby corn is gaining popularity among Indian farming communities mainly due to its short duration, high market rate, nutritive value and also its multiuse. Baby corn is dehusked immature maize ear, harvested within 2-3 days of silking but prior to fertilization **(Pandey *et al.*, 1998)**. Baby corn is highly nutritive as 100 g of baby corn contains 89.1% moisture, 0.2 g fat, 1.9 g protein, 8.2 mg carbohydrate, 0.06 g ash, 28.0 mg calcium, 86.0 mg phosphorus, 11.0 mg ascorbic acid **(Das *et al.*, 2009).** The net income from baby corn is four to five times higher from a single crop than grain maize crop. Therefore, the acerage as well as the production of baby corn is increasing in India.

Baby corn requires higher population and plant nutrition than normal grain corn. Therefore the nutrient management is of immense importance for higher corn production. The chemical fertilizer application may assist in obtaining maximum baby corn production. **Verma *et al.* (2006)** also revealed that 150 per cent recommended NPK gave the maximum plant height of maize. **Bindhani *et al*. (2007)** reported that application of 120 kg N ha^{-1} produced taller plants and higher dry matter production of baby corn. **Kumar *et al.* (2007)** reported that total dry matter production of sweet corn were influenced favourably with increasing levels of N, P_2O_5 and K_2O up to 150:60:40 kg ha^{-1}, respectively. **Suryavanshi *et al*. (2008)** reported that 150 kg N gave higher dry matter production of maize compared to either 50 or 100 kg N ha^{-1}. But keeping in mind that chemical fertilizer may cause hazardous effect to environmental health beside increasing production cost, alternate options are to be explored to minimize the application of chemical fertilizers which include biofertilizers, green manuring, crop residue management, organic manures and specific variety for sustaining crop growth and development. **Soleimanzadeh and Gooshchi (2013)** reported that the application of *Azotobacter* had significant effect to increase the plant height. In general, the maximum plant height (91.9 cm) was obtained at wheat seed inoculation with *Azotobacter*, while the least value (88.8 cm) was

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recorded at without inoculation. Observation made by **Prasad *et al*. (2003)** indicates that application of 5 t ha^{-1} vermicompost along with 14 and 10 t ha^{-1} poultry manure and FYM gave higher dry matter production. **Kudtarkar (2005)** reported that application of 20 t ha^{-1} FYM resulted significantly higher number of leaves and dry matter production of maize over 10 t ha^{-1} FYM as well as control.

The higher baby corn production requires 180:38.7:74.7 kg NPK ha^{-1} **(Singh *et al*., 2010).** It is therefore advised to apply nutrients in an integrated manner which is also reported by different scientists. **Kannan *et al*. (2013)** noticed that integrated nutrient management had positive effect on plant height of maize. **Kalhapure *et al.* (2013)** found significantly taller plants and highest total plant dry matter content at application of 25% RDF+ green manuring with sunhemp+biofertilizers (*Azotobacter*+ PSB)+compost. **Wagh (2002)** reported significantly higher total dry matter production at application of 100 % RDF (225:50:50 kg N, P_2O_5 and K_2O ha^{-1}, respectively) + 5 t FYM ha^{-1} + *Azotobactor* + PSB than other fertilizer and FYM levels. Similar results were also reported by **Kumar *et al*. (2005).** Little research work has been done so far on integrated nutrient management including use of biofertilizers alone or in combination of chemical fertilizers and its effect on productivity and quality of baby corn. So the present study was planned with the objective to evaluate the effect on integrated nutrient management on growth and development of baby corn.

2. Material and Methods

The experiment was conducted at the Instructional Dairy Farm (IDF), Nagla, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Udham Singh Nagar, Uttarakhand, India. The Instructional Dairy Farm is located in the *Tarai* belt of Shivalik range of Himalayas with humid sub-tropical type of climate at latitude of 29°N and longitude of 79.3°E and situated at an altitude of 243.84 m above the mean sea level. The climate of the *Tarai* region is broadly humid sub-tropical with harsh winter and hot dry summers. The soil of the

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experimental field was slightly silty clay loam (Nagla series, Mollisol) in texture, from dark greyish brown to dark grey in humus with weak, fine to medium granular structure.

Eleven treatments were tested in a Randomized Block Design 3 replications the treatments were Control (no application), 50% NPK, 100% NPK(180:60:40), Seed treatment with Azotobacter @200g/10Kg seeds, Seed treatment with Azospirillum @200g/10Kg seeds, Seed treatment with Azospirillum + Azotobacter, 50% NPK + Seed treatment with Azotobacter, 50% NPK + Seed treatment with Azospirillum, 50% NPK+ Seed treatment with Azospirillum + Azotobacter, 50% NPK+ Seed treatment with Azospirillum + Azotobacter and 100%NPK+seed treatment with Azospirillum + Azotobacter. The variety sown was V.L. Baby corn-1 –released from Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora, Uttarakhand.

3. Results and Discussion

3.1 Field emergence percentage

The field emergence remained non significant among all the treatments, however the highest emergence was recorded with 75% NPK+*Azot*+*Azos*, 100% NPK+*Azot*+*Azos* and 50% NPK. This is due to the better soil conditions with application of organics and biofertilizers.

3.2 Plant Population

The highest plant population was recorded with application of 100% NPK+*Azot*+*Azos* that remained significantly at par with 50% NPK, 100% NPK, 50% NPK + seed treatments with biofertilizers and 75% NPK+*Azot*+*Azos*. The higher plant population might be due to better soil physical as well as chemical conditions due to combined application of chemical fertilizer and biofertilizers.

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3.3 Plant height

The plant height of the baby corn increased from 25 DAS to harvest and was affected significantly by different integrated nutrient management practices. At 25 DAS, the tallest plants were recorded with 100% NPK+*Azot*+*Azos* that remained significantly at par with 50% NPK, 100% NPK, 50% NPK + seed treatment with biofertilizers and 75% NPK+*Azot*+*Azos*. The plant height remained non significant under control as well as alone seed treatment with biofertilizers. At harvest, 100% NPK+*Azot*+*Azos* had the tallest plants that remained non significant with 100% NPK, 50% NPK+*Azot*+*Azos* and 75% NPK+*Azot*+*Azos*. Among the biofertilizer treatments, the plant height at 25 DAS and also at harvest remained non significant. Increased plant height may be due to the application of recommended dose of NPK and microbial consortium of nitrogen fixer and PGPR bacterium with nutrient rich organic source like enriched compost. The data pertaining to field emergence, plant population and plant height has been tabulated in Table 1.

3.4 Dry matter accumulation

3.4.1 Crop stage wise dry matter accumulation

The plant dry matter accumulation per plant increased with an advancement of crop age. At 25 DAS (3.03 g/plant), 50 DAS (15.5 g/plant) and harvest (22.2 g/plant), the plant dry matter accumulation was recorded significantly higher with application of 100% NPK+*Azot*+*Azos*. . Among the biofertilizer treatments at 25 DAS, seed treatment with *Azot*+*Azos* produced significantly higher dry matter accumulation and remained at par with seed treatment with *Azotobacter*, but at 50 DAS and at harvest stage, seed treatments with biofertilizers didn't differ significantly amongselves. Higher dose of nitrogen coupled with biofertilizer improved the plant growth and development leading to higher dry matter accumulation.

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3.4.2 Dry matter accumulation in baby corn

Significantly highest dry matter accumulation in baby corn was recorded with application of 100% NPK+*Azot*+*Azos* (413.8 kg/ha) that remained statistically at par with 75% NPK+*Azot*+*Azos* (399.4 kg/ha). The seed treatment with *Azot*+*Azos* (248.9 kg/ha) recorded higher baby corn dry matter than seed treatment with *Azotobacter* (224.1 kg/ha) and *Azospirillum* (193.6 kg/ha) alone. The 50% NPK recorded significantly lowest dry matter compared to 50% NPK+*Azot*, 50% NPK+*Azos* and 50% NPK+*Azot*+*Azos*, however 50% NPK+*Azot*+*Azos* produced significantly higher dry matter that remained non significant with 50% NPK+*Azot*.

Dry matter accumulation in green fodder

Application of 100% NPK+*Azot*+*Azos* (2775.0 kg/ha) recorded significantly higher dry matter of green fodder that remained non significant with 100% NPK (2644.5 kg/ha) and 75% NPK+*Azot*+*Azos* (2728.0 kg/ha). The seed treated with *Azot*+*Azos* produced significantly higher dry matter that remained at par with seed treatment with *Azotobacter* and *Azospirillum*. The 50% NPK also recorded significantly lower dry matter than 50% NPK coupled with biofertillizers but remained non significant with 50% NPK+*Azos*, however 50% NPK+*Azot*+*Azos* had the higher dry matter followed by 50% NPK+*Azot* treatment.

3.4.3 Total dry matter accumulation

Application of 100% NPK+*Azot*+*Azos* (3188.8 kg/ha) gave higher total dry matter production that remained statistically at par with 100% NPK (3028.1 kg/ha) and 75% NPK+*Azot*+*Azos* (3127.4 kg/ha). Seed treatment with *Azot*+*Azos* produced significantly higher total dry matter but remained at par with seed treatment with *Azotobacter* and the seed treatment with *Azospirillum* gave the minimum total dry matter production. Higher dose of nitrogen coupled with biofertilizer improved the plant growth and development, plant population leading to higher dry matter accumulation. The data pertaining to dry matter accumulation has been tabulated in Table 2.

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Table 1: Effect of integrated nutrient management on field emergence percentage, plant population and plant height at different growth stages of baby corn

Treatment	Field emergence %	Plant Population (000/ha)	Plant height (cm)	
			25 DAS	Harvest
Control	87	106	47	138
Azotobacter	87	110	49	145
Azospirillum	86	106	47	143
Azot* +*Azos	86	111	55	155
50% NPK	88	115	61	164
100% NPK	87	123	64	182
50% NPK + *Azotobacter*	87	120	62	166
50% NPK +*Azospirillum*	87	120	61	162
50% NPK + *Azot* + *Azos*	87	122	63	179
75% NPK + *Azot* + *Azos*	88	124	65	181
100% NPK + *Azot* + *Azos*	88	125	67	182
SEm±	1.55	3.5	2.69	4.10
LSD (p=0.05)	ns	11	8	12

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Table 2: Effect of integrated nutrient management on dry matter accumulation of baby corn

Treatment	Dry matter accumulation (g/plant)			Dry Matter (kg/ha)		
	25 DAS	50 DAS	Harvest	Baby Corn	Green Fodder	Total
Control	1.81	8.1	10.3	171.2	1091.8	1263.0
Azotobacter	2.41	11.5	15.3	224.1	1683.0	1907.1
Azospirillum	2.33	10.9	14.5	193.6	1537.0	1730.6
Azot* +*Azos	2.44	11.7	15.8	248.9	1753.8	2002.7
50% NPK	2.60	12.6	17.1	289.1	1966.5	2255.6
100% NPK	3.03	15.2	21.5	383.6	2644.5	3028.1
50% NPK + *Azotobacter*	2.77	13.7	19.3	343.9	2316.0	2659.9
50% NPK +*Azospirillum*	2.63	12.8	17.7	333.0	2124.0	2457.0
50% NPK + *Azot*+ *Azos*	2.87	14.3	20.0	358.9	2440.0	2798.9
75% NPK + *Azot*+ *Azos*	3.07	15.3	22.0	399.4	2728.0	3127.4
100% NPK + *Azot* + *Azos*	3.03	15.5	22.2	413.8	2775.0	3188.8
SEm±	0.03	0 .46	0.52	7.0	73.2	71.7
LSD (p=0.05)	0.08	1.40	1.50	20.6	217.2	213.7

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4. Conclusion

The present study concluded the importance of integrated nutrient management in proper growth and development of baby corn as application of *Azotobacter* and *Azospirillum* along with N, P and K nutrients in the treatment 100% NPK+*Azot*+*Azos* showed pronounced effect on plant growth and produced a taller plant, more plant population and greater plant dry matter throughout the crop season. Highest growth under treatment 100% NPK+*Azot*+*Azos* also confirmed the high nutrient requirement of baby corn.

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