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Production, Nutritional Quality and Economic of Babycorn as Inclined by A Novel Technology of Foliar Nutrition of Zn, NPK & Biofertilizers

Abdul Wahab Hekmat[1], Ziaullah Ahmadzai[2], Ahmad Javid[3] and Gautam Ghosh[4]

[1]PhD, Dept. of Argon. SHUATS, Allahabad, U.P. INDIA.

[2]Associate Professor and Dean of Education Faculty, Paktia University, AFGHANISTAN.

[3]M.Sc. Student, Department of Agriculture Economic, Shuats, Allahabad – 211007, Uttar Pradesh, INDIA

[4]Professor and Dean, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad – 211007, Uttar Pradesh., INDIA.

[1]Corresponding Author: wahabhekmat@gmail.com

ABSTRACT

An experiment was carried out to study the effect of NPK, Zn, biofertilizers and Zn foliar nutrition on yield and economic returns of babycorn. The research was carried out in RCBD with 13 treatments combination *viz.* T_1(Control), T_2 (75 percent recommended dose of fertilizers + 5 kilo gram Zn per hacter + *Azotobacter*),T_3(75 percent recommended dose of fertilizers + 0.2% Zn + *Azotobacter*), T_4(75 percent recommended dose of fertilizers + 0.5% Zn + *Azotobacter*), T_5(90 percent recommended dose of fertilizers + 5 kg Zn ha^{-1}+ *Azotobacter*), T_6 (90 percent recommended dose of fertilizers + 0.2% Zn + *Azotobacter*), T_7(90 percent recommended dose of fertilizers + 0.5% Zn + *Azotobacter*), T_8(75 percent recommended dose of fertilizers + 5 kg Zn ha^{-1}+ *Azospirillum*), T_9(75 percent recommended dose of fertilizers + 0.2% Zn + *Azospirillum*), T_{10}(75 percent recommended dose of fertilizers + 0.5% Zn + *Azospirillum*), T_{11}(90 percent recommended dose of fertilizers + 5 kg Zn ha^{-1}+ *Azospirillum*), T_{12}(90 percent recommended dose of fertilizers + 0.2% Zn + *Azospirillum*) and T_{13}(90 percent recommended dose of fertilizers + 0.5% Zn + *Azospirillum*) in 3 replications. Between the treatments, basal and foliar application of zinc, as well as seed treatment of babycorn with Azatobacter and Azospirillum, significantly influenced yield and yield characteristics of babycorn. Treatment T_{11} had significantly higher average cob girth (5.97 cm), cob length without husk (9.25 cm), cob weight with and without husk (22.27 and 9.75 g), number of cobs per plant (2.93), cob yield with and without husk (10.86 and 2.17 t ha^{-1}) and green fodder yield (50.93 t ha^{-1}) than the other treatments due to the application of 90 percent RDF + 5kg Zn per hectare. Furthermore, as compared to the other treatments, the application of 90% RDF + 5kg Zn ha^{-1} + Azospirillum resulted in significant and maximum protein, carbohydrate, and total sugar content (4.55, 8.49, and 17.97%, respectively).

Keywords- Babycorn, Foliar nutrition, Yield & Yield Attributes, Nitrogen, Phosphorus, Potassium, Quality, Zinc.

I. INTRODUCTION

Baby corn is a cholesterol free vegetable that is sweet, attractive, and healthy. It is a low-calorie vegetable that aids in weight loss, as well as a lower-carbohydrates, higher in fiber, vegetable which is free from fat with a wealth of vitamins and minerals. Baby corn has a lower glycemic index than ordinary corn, making it ideal for blood sugar management. In terms of minerals, one Baby corn may be equated to 1 egg. Its nutritional content is comparable to non-legumes crops such as cauliflower, cabbage, tomato, and cucumber. A 100 g of babycorn contains 89.1 percent moisture, 0.2 g of fat, 1.9 g of protein, 8.2 g of carbohydrates, 0.06 g of ash, 28.0 milligrams of Ca, 86.0 milligrams of P_2O_5, and 11.0 milligrams of ascorbic acid (Rakesh *et al*., 2017). This vegetable has a lot of potential as a cooking ingredient and as a canned product. It's possibly the only vegetable that doesn't have pesticide residues. Baby corn is free from insect and disease, and its nutritional value is equivalent to a variety of high-cost veggies (Pandey *et al.*, 2000). It is also a great fodder crop due to its high succulence, sweetness, and digestibility, and it may be consumed at any stage of its growth (Singh and Singh 2006). The green fodder of babycorn contains lactogenic qualities, making it ideal for milch cattle.

By applying nutrients to agricultural plants via foliar treatment, they biofortify the nutrients, making them available to people when ingested. Soil environmental conditions effect the accessibility of macro and micronutrients which is applied to the soil, resulting in a variety of losses. Foliar application is a strategy for supplying macro and micronutrients that eliminates fertilizer wastage or loss, improves nutrient usage efficiency, and lowers production costs. Nutrients applied foliarly will have an extra advantage in terms of quick absorption. Foliar nutrition can reduce the danger of environmental risks by preventing soil nutrient excess. Nutrient efficiency during foliar nutrition can reach up to 85%, while application of fertilizer in has only 30 to 60 percent efficiency depending on the nutrient type. Foliar fertilizer application has primarily two benefits over soil fertilizer application: about 90% of fertilizers are absorbed by the plant when administered in foliar form, and around 95% of foliar fed nutrients are translocated. If circumstances are ideal, nutrients delivered by foliar application are discovered in the tiniest root within 60

minutes, and foliar fertilizer utilization efficiency in sandy loam soils is up to 20 times higher than soil applied fertilizers. Finally, Baby corn is a fascinating short-term attraction. Cereal vegetables are chosen by the upper crust of society since they can be planted all year. It is a dual-purpose crop that provides both food and fodder for cattle, as well as an excellent catch crop with a short growing season (55–60 days) and a strong income crop. The cultivation of baby corn can increase both income and employment. Fertility control is crucial in the creation of babycorn, and it can only reach its full potential if it is given enough nutrients in the right amounts at the right time. This is especially crucial for increasing babycorn and green fodder yields, as well as conserving soil fertility.

II. METHODOLOGY

Field research was carried out in a RCBD with 3 replications at the Agronomy Crop Research Farm, SHUATS, U.P. India to study the influence of Nitrogen, Phosphorus, Potassium, biofertilizers, and Zn foliar application on productivity and nutritional quality of babycorn during the summer season of 2019. The cultivar G-5414 was used for the investigation. The treatments consist of 13 treatments combination *viz.* T_1(Control), T_2(75 percent recommended dose of fertilizers + 5 kilo gram Zn per hacter + *Azotobacter*),T_3(75 percent recommended dose of fertilizers + 0.2% Zn + *Azotobacter*), T_4(75 percent recommended dose of fertilizers + 0.5% Zn + *Azotobacter*), T_5(90 percent recommended dose of fertilizers + 5 kg Zn ha^{-1}+ *Azotobacter*), T_6 (90 percent recommended dose of fertilizers + 0.2% Zn + *Azotobacter*), T_7(90 percent recommended dose of fertilizers + 0.5% Zn + *Azotobacter*), T_8(75 percent recommended dose of fertilizers + 5 kg Zn ha^{-1}+ *Azospirillum*), T_9(75 percent recommended dose of fertilizers + 0.2% Zn + *Azospirillum*), T_{10}(75 percent recommended dose of fertilizers + 0.5% Zn + *Azospirillum*), T_{11}(90 percent recommended dose of fertilizers + 5 kg Zn ha^{-1}+ *Azospirillum*), T_{12}(90 percent recommended dose of fertilizers + 0.2% Zn + *Azospirillum*) and T_{13}(90 percent recommended dose of fertilizers + 0.5% Zn + *Azospirillum*) in 3 replications. During the year 2019, soil of the experimental site was sandy loam with the soil in the study area was sandy loam with a moderately alkaline pH (7.14), with 159.80 kg per hectare nitrogen, 14.39 kg per hectare P_2O_5. Before sowing babycorn seeds were treated with bio fertilizers and 2 to 3 seeds were sown per hole, spacing was maintained at 45 x 20 cm in line sowing, and protected with soil. At the time of sowing, recommended dose of NPK at the rate of 120:60:40 kilograms per hectare and $ZnSo_4$ at a rate of 5 kilograms per hectare were applied. At 25 days after sowing, the whole quantity of Phosphorus and half the authorized amounts of nitrogen, as well as complete doses of potassium and Zn, were applied as a basal application, and the lasting amount of nitrogen was applied as a top dressing. At 25 and 45 days following seeding, a zinc foliar spray was sprayed. Irrigation was provided as needed and standard cultural practices were observed. A sample of five plants was chosen at random to record various yield observations on babycorn. The mean number of cobs per plant was calculated from the number of cobs counted from the sampling plants. The girth of the cob was measured using a Varner caliper and represented in centimeters, then calculated with x cob diameter, Cobs from the tagged plants were measured for length with and without husk, as well as weight, and mean length, girth, and weight were computed. Cobs' sheaths were peeled away, and the length, girth, and weight of the cobs were measured. Harvested cobs from the net plot were weighed, and cob yield was reported in kg ha^{-1} from separate plots. From the net plots the babycorn stalks were gathered after the cobs were harvested, weighed, and stated as green fodder yield in tons per hectare. The data were statistically analyzed.

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III. RESULT AND DISSCUSSION

Yield Attributes of babycorn

Yield attributes of babycorn significantly influenced by application of various level of nitrogen, phosphorus, potassium and Zn as basal and foliar application. Data on various yield attributes in baby corn was presented in Table1and 2. Application of 90 percent recommended dose of fertilizers + 5 kilogram zinc per hectare + *Azospirillum* (T_{11}) recorded significant and maximum cob girth (5.97 cm), length of cob without husk (9.25 cm), weight of cob with and without husk (22.27 and 9.75 g), No. cobs $plant^{-1}$ (2.93), cob yield with husk and without husk (10.86 and 2.17 t ha^{-1}) and fodder yield (50.93 in tons per hectare) followed by T_{13} (90% RDF + 0.5% Zn foliar application + *Azospirillum*) as compared to rest of the treatments. Whereas, the lower data for yield and yield parameters were registered in T_1.

Yield is the end result of various yield-contributing constituents, physiological, and morphological processes occurring in crops at their growth and development (Mona, 2015). Zinc fertilization improves physiological processes, plant metabolism, and plant development, resulting in increased yield. The combined impact of macro and micro nutrients was responsible for the increase in cob length and girth. The outcomes are in line with Roopashree's expectations (2013). Because potassium is taking part during the transit of CHO to the sink, the increment in weight of cob might be due the favorable impact used by K_2O. Zinc as a foliar nutrient is used for protein synthesis, ensures quality, consistent maturity, and greater nitrogen absorption by the plant, resulting in enhanced photosynthesis and cob weight. The findings are consistent with Manja Naik's (2012) and Manasa and Devaranavadagi's (2013) studies (2015). Furthermore, increased growth characteristics, resulted in increased TDM production $plant^{-1}$, resulting in

better green fodder yield in comparison with rest of the treatments. The results are in conformity with Asghar *et al*., (2011) and Parasuraman (2008). Higher nutrient absorption by the plants might be interpreted as improved yield and growth characteristics. A basic step in achieving greater yield is to increase dry matter output per unit area. TDM production in several growth stages of any crop is an essential criterion for greater yields since it indicates the crop's photosynthetic potential (Asghar *et al*., 2011). Furthermore, an increment in biological yield output may be attributable to improved photosynthate translocation with applied zinc, resulting in increased green fodder production at the corresponding nutrient levels. Mahdi *et al*. (2012), Balwinder kumar *et al*. (2013) and Mona (2015) reported similar results of considerably greater fodder output with Zn treatment.

Nutritional quality of babycorn

The nutritional quality such as protein, carbohydrate and total sugar content was effected by NPK, biofertilizers and zinc foliar application. Application of 90 percent recommended dose of fertilizers + 5-kilogram zinc per hectare + *Azospirillum* recorded significant and maximum protein, carbohydrate and total sugar content (4.55, 8.49 and 17.97 percent) respectively in comparison with other treatments.

The higher nitrogen concentration in the cobs may be due to increased nitrogen uptake and timely supply of nitrogen fertilizer through soil application of zinc as foliar application of zinc reduced nitrogen loss through leaching and volatilization, resulting in an increase in net photosynthesis facilitated by the increased leaf area. The use of zinc, which catalyzes the nitrate reductase enzyme and activates the production of protein, has once again aided nitrogen 16 uptake. The increased protein content in cobs as a result of foliar fertilization agrees with Amal *et al* (2006) and Arune *et al* (2006). However, the increment in total sugar content was might be due to better K_2O availability through foliar application of nutrients, which caused in the carriage of more solutes to the sink and improved photosynthetic activity in the leaf, which was primarily administered by the existence of trace elements like manganese in the foliar fertilizers, as well as a better source-sink relationship, which directly influenced the sugar content of baby corn. The outcomes are consistent with Manja Naik's expectations (2012).

Table 1: The effect of varying doses of NPK and Zinc, as well as seed inoculation with Azotobacter and Azospirillum, on yield and yield attributes of babycorn

Treatments	Cob girth (cm)	Cob length without husk (cm)	Cob weight with husk (g)	Cob weight with husk (g)	No of cobs per plant
T_1: Control	4.96	8.08	16.94	6.06	2.20
T_2: 75 Percent Recommended dose of fertilizers + 5 kilogram Zn per hectare + *Azotobacter*	5.80	8.61	21.59	8.11	2.80
T_3: 75 Percent Recommended dose of fertilizers + 0.2% Zinc + *Azotobacter*	5.07	8.07	17.40	6.68	2.67
T_4: 75 Percent Recommended dose of fertilizers + 0.5% Zinc + *Azotobacter*	5.53	8.69	17.80	8.07	2.67
T_5: 90 Percent Recommended dose of fertilizers + 5 kilogram Zn per hectare + *Azotobacter*	5.59	8.97	20.27	9.35	2.87
T_6: 90 Percent Recommended dose of fertilizers + 0.2% Zinc + *Azotobacter*	5.71	8.49	17.73	8.08	2.80
T_7: 90 Percent Recommended dose of fertilizers + 0.5% Zinc + *Azotobacter*	5.53	8.69	18.14	8.41	2.73
T_8: 75 Percent Recommended dose of fertilizers + 5 kilogram Zn per hectare + *Azospirillum*	5.53	8.88	18.60	8.09	2.80
T_9: 75 Percent Recommended dose of fertilizers + 0.2% Zinc + *Azospirillum*	5.48	7.93	17.13	7.08	2.73
T_{10}: 75 Percent Recommended dose of fertilizers + 0.5% Zinc + *Azospirillum*	5.53	8.45	17.33	8.31	2.87
T_{11}: 90 Percent Recommended dose of fertilizers + 5 kilogram Zn per hectare + *Azospirillum*	5.97	9.25	22.27	9.75	2.93
T_{12}: 90 Percent Recommended dose of fertilizers + 0.2% Zinc + *Azospirillum*	5.51	8.63	18.27	8.35	2.67
T_{13}: 90 Percent Recommended dose of fertilizers + 0.5% Zinc + *Azospirillum*	5.55	9.12	21.07	9.00	2.73
SEM±	**0.14**	**0.26**	**0.83**	**0.34**	**0.08**
C.D. at 5%	**0.40**	**0.76**	**2.43**	**0.99**	**0.23**

Table 2: The effect of varying doses of NPK and Zinc, as well as seed inoculation with Azotobacter and Azospirillum, on yield and yield attributes of babycorn

Treatments	Green Cob yield in ton per hectare		Green Fodder Yield in tons per hectare	Harvest Index (%)
	With husk	Without husk		
T_1: Control	5.92	1.18	32.62	3.49
T_2: 75 Percent Recommended dose of fertilizers + 5 kilogram Zn per hectare + *Azotobacter*	6.73	1.35	39.98	3.38
T_3: 75 Percent Recommended dose of fertilizers + 0.2% Zinc + *Azotobacter*	6.01	1.20	36.62	3.32
T_4: 75 Percent Recommended dose of fertilizers + 0.5% Zinc + *Azotobacter*	6.04	1.21	38.93	3.27
T_5: 90 Percent Recommended dose of fertilizers + 5 kilogram Zn per hectare + *Azotobacter*	8.67	1.73	44.61	3.71
T_6: 90 Percent Recommended dose of fertilizers + 0.2% Zinc + *Azotobacter*	8.18	1.64	41.67	3.59
T_7: 90 Percent Recommended dose of fertilizers + 0.5% Zinc + *Azotobacter*	8.68	1.74	41.88	4.35
T_8: 75 Percent Recommended dose of fertilizers + 5 kilogram Zn per hectare + *Azospirillum*	6.79	1.36	41.25	3.48
T_9: 75 Percent Recommended dose of fertilizers + 0.2% Zinc + *Azospirillum*	6.01	1.20	39.98	3.06
T_{10}: 75 Percent Recommended dose of fertilizers + 0.5% Zinc + *Azospirillum*	6.28	1.26	41.04	3.16
T_{11}: 90 Percent Recommended dose of fertilizers + 5 kilogram Zn per hectare + *Azospirillum*	10.86	2.17	50.93	4.12
T_{12}: 90 Percent Recommended dose of fertilizers + 0.2% Zinc + *Azospirillum*	7.33	1.47	44.19	3.68
T_{13}: 90 Percent Recommended dose of fertilizers + 0.5% Zinc + *Azospirillum*	9.00	1.73	45.58	3.53
SEM±	**0.74**	**0.16**	**1.85**	**0.39**
C.D. at 5%	**2.15**	**0.47**	**5.40**	**NS**

FIGURE 1: Effect of Zinc foliar nutrition, NPK and biofertilizer on cob yield and green fodder yield (t/ha)

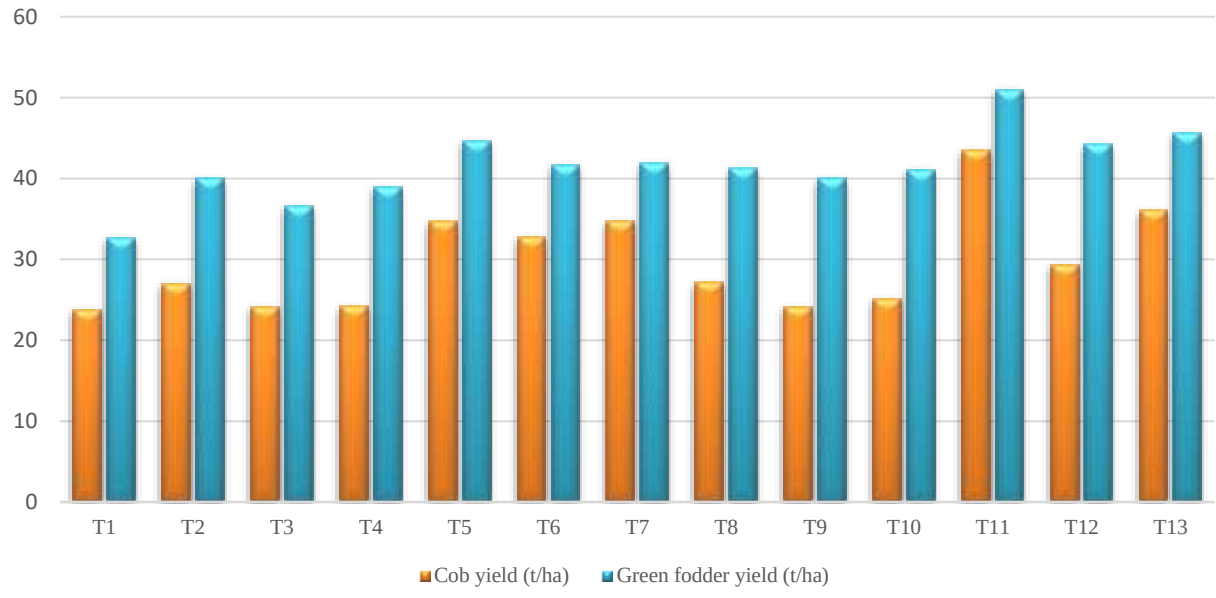

Table 3: The effect of varying doses of NPK and Zinc, as well as seed inoculation with Azotobacter and Azospirillum, on quality parameters in babycorn

Treatments	Content (%)			
	Moisture	**Carbohydrate**	**Protein**	**Total Sugar**
T_1: Control	93.48	8.01	3.65	14.49
T_2: 75 Percent Recommended dose of fertilizers + 5 kilogram Zn per hectare + *Azotobacter*	89.19	8.22	4.19	15.53
T_3: 75 Percent Recommended dose of fertilizers + 0.2% Zinc + *Azotobacter*	91.02	8.12	4.04	15.04
T_4: 75 Percent Recommended dose of fertilizers + 0.5% Zinc + *Azotobacter*	90.11	8.12	4.10	15.29
T_5: 90 Percent Recommended dose of fertilizers + 5 kilogram Zn per hectare + *Azotobacter*	82.27	8.43	4.46	17.55
T_6: 90 Percent Recommended dose of fertilizers + 0.2% Zinc + *Azotobacter*	84.46	8.32	4.33	16.55
T_7: 90 Percent Recommended dose of fertilizers + 0.5% Zinc + *Azotobacter*	82.91	8.41	4.38	17.13
T_8: 75 Percent Recommended dose of fertilizers + 5 kilogram Zn per hectare + *Azospirillum*	88.14	8.29	4.23	15.95
T_9: 75 Percent Recommended dose of fertilizers + 0.2% Zinc + *Azospirillum*	87.42	8.16	4.03	15.58
T_{10}: 75 Percent Recommended dose of fertilizers + 0.5% Zinc + *Azospirillum*	88.38	8.22	4.20	15.96
T_{11}: 90 Percent Recommended dose of fertilizers + 5 kilogram Zn per hectare + *Azospirillum*	80.80	8.49	4.55	17.97
T_{12}: 90 Percent Recommended dose of fertilizers + 0.2% Zinc + *Azospirillum*	83.61	8.36	4.29	17.12
T_{13}: 90 Percent Recommended dose of fertilizers + 0.5% Zinc + *Azospirillum*	81.67	8.43	4.41	17.20
SEM.±	**0.94**	**0.08**	**0.06**	**0.16**
C.D. at 5%	**2.73**	**0.23**	**0.17**	**0.45**

IV. CONCLUSION

From the result of the experiment it has been decided that amongst the several treatments investigated in babycorn., application of 90% RDF + 5kilogram Zn per hectare + *Azospirillum* and (90% RDF + 0.5% Zn foliar application + *Azospirillum*) recorded significantly higher baby corn yield, crude protein, carbohydrate and total sugar percentage and showed improvement in recording greater zinc concentration in biological yield and babycorn was found economically viable with greater net returns and B:C ratio.

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