Plant Archives Vol. 24, Special Issue (GABELS), 2024 pp.73-79 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org

DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2024.v24.SP-GABELS.012

DIFFERENT NUTRIENT LEVELS AND LIQUID ORGANIC MANURES AS INFLUENCED ON GROWTH, YIELD ATTRIBUTES AND YIELD OF SWEET CORN (*ZEA MAYS* L.VAR. SACCHARATA)

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ABSTRACT

The experiment was carried out during 2022 *kharif* season at Indira Gandhi Krishi Vishwavidyalaya, Instructional cum Research Farm, Raipur (C.G.). The main objective was to explore out the different nutrient levels and liquid organic manures as influenced on growth, yield attributes and yield of sweet corn. Among the different nutrient levels, 125% RDN through organic manures *i.e.*,1/3rd FYM + 1/3rd vermi compost + 1/3rd neem cake was significantly superior in terms growth attributes *i.e.*, plant height and dry matter, yield attributes *i.e.*, number of grain rows cob^{-1}, number of grains row $^{-1}$, number of grains cob^{-1}, cob weight with husk and without husk, green cob yield and green fodder yield of sweet corn. Out of various liquid organic manures, cow urine treatment superior in terms Growth, Yield attributes and Yield of Sweet corn.

Keywords: Nutrient levels, Liquid organic manures, Growth, Green cob yield, Yield attributes and Sweet corn.

Introduction

Maize *(Zea mays* L.) a crop used for both food and fodder, is a member of the Poaceae family. The third most significant cereal grain crop in India, after rice and wheat. It is regarded as the "Queen of Cereals" and a crop with a short growing season that is more adaptable under a variety of agro-climatic conditions. A naturally occurring recessive mutation in the genes that regulate the conversion of sugar to starch inside the maize kernel's ENO is the cause of sweet corn. Sweet corn is taken at an immature stage (milk stage) and prepared and consumed as a vegetable rather than a grain, in contrast to field corn types, which are collected when the kernels are dry and developed (dent stage). Sweet corn does not keep well and must be consumed right once to avoid the kernels turning tough and starchy. Since maturity entails the conversion of sugar to starch. The protein content of sweet corn ranges from 2.86 to 3.70 per cent. Ferulic acid, which has anti-cancer qualities, is produced in greater quantities during the cooking of sweet corn.

People's interest in organic farming has grown as they become more concerned about crop quality and soil health (Sharma *et al*., 2008). Organic farming improves soil organic carbon, accessible nutrient content, microbial population and enzymatic activity, making it more sustainable for the development of organic crops. To achieve maximum crop output with the least amount of input and to maintain soil fertility, it is necessary to employ balanced nutrients from organic sources such as farmyard manure, vermicompost, green manure, neem cake and bio-fertilizers (Dahiphale *et al*., 2003). The application of liquid organic manures such as *jeevamrutha* and vermiwash promotes crop growth, yield and quality. Cow urine has a high manurial value and is appropriate for use as a bio fertilizer. It contains 95% water, 2.5% urea, 2.5% hormones, salt, minerals and 2.5% enzymes. It also contains minerals like phosphorus,

potassium, iron, calcium, uric acid, lactose and cytokine, as well as enzymes and amino acids (Bhadauria, 2002). Because of its organic origin, it has no harmful impact on soil biology or human health when utilized in crops. Cow urine is a rich source of plant nutrients and antifungal properties. It improves soil texture and has also been used as a plant hormone to alleviate vitamin deficiencies. Vermiwash rich in macronutrients *i.e.,* N, P, K, Ca and growth regulators like auxin and cytokinin (Raiand Bansiwal, 2008). *Jeevamrutha* is rich in macronutrients, micronutrients, vitamins, essential amino acids, growth regulators such as IAA and GA, and beneficial microbes (Gadewar *et al*., 2014).

In this context, it is worth studying nutrient management practices through organics. The soil health is maintained by the use of organics by improving the soil organic matter, physio-chemical properties and beneficial microbes. Keeping in this, present experiment was conducted with objective to study the different nutrient levels and liquid organic manures as influenced on growth attributes, yield attributes and yield of sweet corn.

Materials and Methods

This experiment was carried out during *Kharif* season 2022 at Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.). The soil was Inceptisol being neutral in reaction (pH 7.5) with organic carbon content of 0.65%, low available nitrogen (240 kg ha^{-1}), medium in phosphorus (17.6 kg ha^{-1}) and high potassium (345.0 kg ha^{-1}) status. The study was carried out with four different nutrient levels in horizontal strips *i.e.* N_1: 125 % RDN, N_2: 100 % RDN, N_3: 75 % RDN, N_4: Control and four different liquid organic manures *i.e.* L_1: *Jeevamrit*, L_2: Vermiwash, L_3: Cow urine, L_4: Control were arranged in vertical strips laid out in strip plot design with three replications. Weeding was done twice manually. The plant height, dry matter production per $plant^{-1}$, number of grains row^{-1}, number of rows cob^{-1}, number of grains cob^{-1}, cob weight with husk and without husk was counted by taking 5 observations mean and green cob yield and fodder yield was recorded from net plot area after removing the border area. Statistical analysis was carried after collection of data with the procedure given by Panse and Sukhatme (1967).

Results and Discussion

Effect of different nutrient levels and liquid organic manures on growth

Plant height (cm)

The data presented in Table 1indicated that the plant height significantly varied due to different nutrient levels and liquid organic manures from beginning to till harvest. Among the different nutrient levels N_1 (125% RDN) treatment was recorded significantly highest plant height with a mean height of (60.68 cm), (147.49 cm), (202.53 cm) and (204.98 cm) compared remaining treatments at 20, 40, 60 DAS and at harvest respectively, it was found to be on par with N_2 at 20 DAS, 40 DAS, 60 DAS and at harvest with mean plant height (56.79 cm), (138.80 cm), (199.65 cm) and (202.33 cm), respectively. The lowest plant height was recorded in N_4 treatment with a mean height of (47.54 cm), (111.30 cm), (142.28 cm) and (145.81 cm) at 20, 40, 60 DAS and at harvest respectively.

Among various liquid organic manures L_3 (cow urine) treatment was recorded significantly highest plant height with a mean height of (60.93 cm), (141.90 cm), (192.55 cm) and (194.68 cm) as compared to remaining treatments at 20, 40, 60 DAS and at harvest respectively. However, L_3 result was found to be at par with L_1 (56.70 cm) at 20 DAS. Similarly at 60 DAS and harvest it was at par with L_1 (189.07 cm), (191.13 cm) and L_2 (183.74 cm), (186.76cm) respectively. The lowest plant height was recorded in L_4 treatment with a mean height of (46.63 cm), (118.23 cm), (169.66 cm) and (173.90cm) at 20, 40, 60 DAS and at harvest respectively. The interaction effect of nutrient levels and liquid organic manures on plant height was found to be non-significant.

Dry matter accumulation $plant^{-1}$ (g)

The data depicted in Table 2. Showed that 125% RDN (N_1) treatment produced the significantly highest dry matter with mean value (3.40 g $plant^{-1}$), (38.75 g $plant^{-1}$), (82.63 g $plant^{-1}$) and (106.43 g $plant^{-1}$) at 20, 40, 60 DAS and at harvest respectively, but it was at par with N_2 (3.33 g $plant^{-1}$) and N_3 (3.15 g $plant^{-1}$) at 20 DAS. The lowest dry matter produced in N_4 (control) at 20, 40, 60 DAS and at harvest *i.e.* (2.55 g $plant^{-1}$), (20.28 g $plant^{-1}$), (47.25 g $plant^{-1}$) and (59.11 g $plant^{-1}$) respectively.

On the other hand, among various liquid organic manures highest dry matter was produced under L_3 (cow urine) treatment *i.e.* (3.54 g $plant^{-1}$), (35.46 g $plant^{-1}$), (76.31 g $plant^{-1}$) and (97.60 g $plant^{-1}$) at 20, 40, 60 DAS and at harvest respectively. The minimum dry matter was produced in L_4 (control) treatment *i.e.* (2.61 g $plant^{-1}$), (24.43 g $plant^{-1}$), (58.39 g $plant^{-1}$) and (79.22 g $plant^{-1}$) at 20, 40, 60 DAS and at harvest. The interaction effect of nutrient levels and liquid organic manures on dry matter accumulation $plant^{-1}$ found to be non-significant.

Effect of different nutrient levels and liquid organic manures on yield attributes:

Number of cobs plant^{-1}

Number of cobs plant^{-1}data presented in Table 3. Data showed that there was no significant difference in number of cobs plant^{-1}with different nutrient levels and liquid organic manures.

Cob weight with husk and without husk (g)

The perusal of data (Table 3) it showed that significantly difference in cob weight with and without husk due to various nutrient levels and liquid organic manures. Application of 125% RDN (N_1) treatment recorded significantly maximum cob weight with husk (306.9 g) and without husk (274.3 g) as compared with other nutrient levels.N_4 (control) treatment recorded minimum cob weight with husk (167.9 g) and without husk (143.9 g).Out of various liquid organic manures significantly maximum cob weight with husk (274.0 g) and without husk (242.3 g) was recorded in L_3 (cow urine) as compared to other treatments. However, L_3 result cob weight with husk was found to be at par with L_1 (265.3). The minimum cob weight husk with (240.6 g) and without husk (214.6 g) was obtained in L_4 (control) treatment.

The interaction effect of nutrient levels and liquid organic manures on cob weight with and without husk was found to be significant and data presented in Table 4 and 5 respectively. It was clear from the data N_1 (125% RDN) + L_3 (cow urine) combination recorded significantly higher cob weight with husk, but it was at par with N_1 (125% RDN) + L_1 (*Jeevamrit*), N_1 (125% RDN) + L_2 (Vermiwash) and N_2 (100% RDN) + L_3 (cow urine). The lowest cob weight with husk was obtained under N_4 (control) + L_4 (control) treatment combination. Significantly higher cob weight without husk obtained under N_1 (125% RDN) + L_3 (cow urine) combination, it was at par with N_2 (100% RDN) + L_3 (cow urine). The lowest cob weight without husk was recorded in N_4 (control) + L_4 (control) treatment combination.

Number of grain rows cob^{-1}

The data related to number of grain rows cob^{-1} presented in the Table 3. Among different nutrient levels N_1 (125% RDN) treatment was recorded significantly higher number of grain rows cob^{-1} (16.5 grain rows) and it was at par with N_2 (100% RDN). The lowest number of grain rows cob^{-1} (13.3 grain rows) was recorded in N_4 (control) treatment. Among the various liquid organic manures significantly higher number of grain rows cob^{-1} (16.7 grain rows) was recorded under L_3 (cow urine) as compared to remaining treatments. The lowest number of grain rows cob^{-1} (13.7 grain rows) was recorded in L_4 (control) treatment. The interaction effect of nutrient levels and liquid organic manures was found to be non-significant on grain rows cob^{-1} of sweet corn. The outcomes found to be concurred with Yogananda *et al*. (2017) and Prasanna *et al*. (2020).

Number of grains row^{-1}

It was evident from the Table 3 that out of various nutrient levels significantly maximum number of grains row^{-1} (35.1 grains) was recorded in N_1 (125% RDN) as compared to remaining treatments, but it was at par with N_2 (34.0 grains). The N_4 (control) treatment was recorded minimum number of grains row $^{-1}$ (20.9 grains). Whereas, different liquid organic manures L_3 (cow urine) treatment was recorded significantly maximum number of grains row^{-1} (32.6 grains). L_3 treatment was found to be at par with L_1 (31.9) and L_2 (31.3). The minimum number of grains row^{-1} (26.8 grains) was recorded in L_4 (control) treatment. The interaction between nutrient levels and liquid organic manures on number of grains row^{-1} of sweet corn was found to be non-significant. The results were similar with Veeresha *et al.* (2014).

Number of grains cob^{-1}

It was very clear from the Table 3, significantly maximum number of grains cob^{-1} (585.0 grains) was recorded fewer than 125% RDN (N_1) nutrient level as compared with other levels. The minimum number of grains cob^{-1} (292 grains) was recorded in N_4 (control) treatment. Although among the different liquid organic manures, L_3 (cow urine) was recorded significantly maximum number of grains cob^{-1} (551.7 grains). The minimum number of grains cob^{-1} (363.3 grains) was recorded in L_4 (control) treatment. The interaction between nutrient levels and liquid organic manures was non-significant for number of grains cob^{-1}. Obtained results weresimilartothe findingsofThakur *et al.*(2015).

Effect of different nutrient levels and liquid organic manures on yield

Green cob yield (t ha^{-1})

The data presented in Table 3 showed that green cob yield significantly differed among the nutrient levels and liquid organic manures. Various levels of nutrient, 125% RDN (N_1) treatment was recorded significantly highest green cob yield (14.4 t ha^{-1}). It was found to be at par with 100% RDN (14.1 t ha^{-1}). The lowest green cob yield (6.7 t ha^{-1}) recorded in N_4 (control) treatment. As regard to different liquid organic manures, highest green cob yield (13.0 t ha^{-1}) recorded under L_3 (cow urine) and which was at par

with L_1 (12.5 t ha^{-1}). The lowest green cob yield (10.3 t ha^{-1}) was recorded under L_4 (control) treatment. These findings were coincidence with Mahamood *et al.* (2016).

The interaction between nutrient levels and liquid organic manures was significant for green cob yield (Table 6). It has been observed that treatment combination of N_1 (125% RDN) + L_3 (cow urine) recorded higher green cob yield as compared to other interactions. The minimum green cob yield was obtained under N_4 (control) + L_4 (control) treatment combination.

Green fodder yield (t ha^{-1})

Data pertained to green fodder yield was presented in Table 3. Out of different nutrient levels, significantly highest green fodder yield (20.3 t ha^{-1}) recorded under N_1 (125% RDN) as compared to other nutrient levels. N_4 (control) treatment was recorded lowest green fodder yield (9.7 t ha^{-1}). Among various liquid organic manures, L_3 (cow urine) treatment was recorded maximum green fodder yield (19.7 t ha^{-1}) as compared to other treatments. The minimum green fodder yield (14.7 t ha^{-1}) was recorded in L_4 (control) treatment. These results were similar to Ramesh *et al*. (2018). The interaction effect of nutrient levels and liquid organic manures on green fodder yield was found to be significant and data presented in Table 7. It was clear from the data N_1 (125% RDN) + L_3 (cow urine) combination recorded significantly higher green fodder yield and it was at par with N_2 (100% RDN) + L_3 (cow urine). The lowest green fodder yield obtained under N_4 (control) + L_4 (control) treatment combination.

Higher growth, yield attributes and yield were observed under N_1 (125% RDN) treatment as compared to other nutrient levels. It may be due to application of higher level of nutrients (125% RDN) through incorporation of 1/3rd FYM + 1/3rd vermi compost + 1/3rd neem cake at the time of sowing which tremendously enhanced microbiological activities in the soil so that decomposition rate of organic matter increased and after decomposition of organic matter it released many major and micronutrients in slow and steady rate pattern, plant growth hormones and enzymes throughout the crop growth period which are enhances the physiological and metabolic activities of plant, thus ultimately increases yield attributes of sweet corn.

Cow urine (L_3) treatment was recorded significantly highest growth, yield attributes and yield of sweet corn as compared to remaining liquid organic manures. It may due to continuously application of cow urine @ 200 litre ha^{-1} at 7 days interval through drip which is an excellent source of nitrogen as well as enzymes and hormones and these are enhances the cell size, carbohydrates synthesis, protein synthesis which are favors the increase in growth and yield attributes of sweet corn.

Table 1: Plant height of sweet corn as influenced by different nutrient levels and liquid organic manures at various time intervals.

Treatments	Plant height (cm)			
	20 DAS	40 DAS	60 DAS	At harvest
Nutrient levels (N)				
N_1 (125% RDN)	60.68	147.49	202.53	204.98
N_2 (100% RDN)	56.79	138.80	199.65	202.33
N_3 (75% RDN)	52.63	128.45	190.86	193.36
N_4 (Control)	47.54	111.30	142.28	145.81
SEm±	**1.78**	**3.73**	**4.47**	**3.87**
CD (P=0.05)	**4.36**	**9.13**	**10.95**	**9.47**
Liquid organic manures (L)				
L_1 (*Jeevamrit*)	56.70	134.65	189.07	191.13
L_2 (Vermiwash)	53.39	131.26	183.74	186.76
L_3 (Cow urine)	60.93	141.90	192.55	194.68
L_4 (Control)	46.63	118.23	169.66	173.90
SEm±	**1.95**	**2.75**	**5.02**	**5.56**
CD (P=0.05)	**4.79**	**6.73**	**12.29**	**13.62**
Interaction N×L	**NS**	**NS**	**NS**	**NS**

Table 2: Dry matter accumulation of plant^{-1} of sweet corn as influenced by different nutrient levels and liquid organic manures at various time intervals.

Treatments	Dry matter accumulation plant^{-1} (g)			
	20 DAS	40 DAS	60 DAS	At harvest
Nutrient levels (N)				
N_1 (125% RDN)	3.40	38.75	82.63	106.43
N_2 (100% RDN)	3.33	32.88	75.69	99.76
N_3 (75% RDN)	3.15	28.85	66.62	89.06
N_4 (Control)	2.55	20.28	47.25	59.11
SEm±	**0.10**	**0.79**	**2.10**	**2.34**
CD (P=0.05)	**0.26**	**1.94**	**5.15**	**5.74**
Liquid organic manures (L)				
L_1 (*Jeevamrit*)	3.27	31.65	70.53	91.08
L_2 (Vermiwash)	3.02	29.22	66.96	86.46
L_3 (Cow urine)	3.54	35.46	76.31	97.60
L_4 (Control)	2.61	24.43	58.39	79.22
SEm±	**0.10**	**0.73**	**1.93**	**2.15**
CD (P=0.05)	**0.26**	**1.79**	**4.74**	**5.27**
Interaction N×L	**NS**	**NS**	**NS**	**NS**

Table 3: Number of cobs plant^{-1}, cob weightwith husk and without husk, number of grain rows cob$^{-1,}$ number of grains row $^{-1}$ and number of grains cob^{-1} of sweet corn as influenced by different nutrient levels and liquid organic manures.

Treatments	Number of cobs plant^{-1}	Cob weight (g)		Number of grain rows cob^{-1}	Number of grains row $^{-1}$	Number of grains cob $^{-1}$	Green cob yield (t ha^{-1})	Green fodder yield (t ha^{-1})
		With husk	Without husk					
Nutrient levels (N)								
N_1(125% RDN)	1.22	306.9	271.3	16.5	35.1	585.0	14.4	20.3
N_2(100% RDN)	1.16	299.4	262.2	16.1	34.0	549.1	14.1	19.5
N_3(75% RDN)	1.13	269.7	246.4	15.7	32.0	502.0	12.9	18.7
N_4 (Control)	1.13	167.3	143.9	13.3	20.9	279.5	6.7	9.7
SEm±	0.03	**2.18**	**3.04**	**0.24**	**0.46**	**8.73**	0.31	0.23
CD (P=0.05)	**NS**	**5.35**	**7.45**	**0.59**	**1.13**	**21.38**	**0.76**	**0.57**
Liquid organic manures (L)								
L_1 (*Jeevamrit*)	1.16	265.4	235.1	15.9	31.9	513.8	12.5	17.3
L_2 (Vermiwash)	1.16	263.5	230.0	15.4	31.3	486.8	12.3	16.6
L_3 (Cow urine)	1.18	274.0	242.3	16.7	32.6	551.7	13.0	19.7
L_4 (Control)	1.14	240.6	216.5	13.7	26.1	363.3	10.3	14.7
SEm±	**0.02**	**4.22**	**2.52**	**0.25**	**0.76**	**13.43**	**0.27**	**0.44**
CD (P=0.05)	**NS**	**10.34**	**6.19**	**0.60**	**1.88**	**32.86**	**0.67**	**1.09**
Interaction N×L	**NS**	**S**	**S**	**NS**	**NS**	**NS**	**S**	**S**

Table 4: Cob weight with husk of sweet corn as influenced by interaction of nutrient levels and liquid organic manures.

Treatments	Nutrient levels (N)				Mean
	N_1	N_2	N_3	N_4	
	Liquid organic manures (L)				
L_1	309.3	304.9	270.3	176.9	**265.3**
L_2	308.2	301.3	268.4	176.1	**263.5**
L_3	318.3	317.8	283.1	177.0	**274.0**
L_4	292.0	273.8	257.3	139.2	**240.6**
Mean	**306.9**	**299.4**	**269.8**	**167.3**	
	N	**L**	**N×L**		
SEm±	2.18	4.2	5.43		
CD (P=0.05)	5.35	10.34	11.27		

Table 5: Cob weight without husk of sweet corn as influenced by interaction of nutrient levels and liquid organic manures.

Treatments	Nutrient levels (N)				Mean
	N_1	N_2	N_3	N_4	
	Liquid organic manures (L)				
L_1	274.2	263.6	250.2	152.3	**235.1**
L_2	270.4	253.6	248.2	147.9	**230.0**
L_3	282.2	279.4	253.7	153.9	**242.3**
L_4	258.5	252.4	233.4	121.4	**216.5**
Mean	**271.3**	**263.2**	**246.4**	**143.9**	
	N	**L**	**N×L**		
SEm±	**3.04**	**2.52**	**3.78**		
CD (P=0.05)	**7.45**	**6.19**	**7.86**		

Table 6: Green cob yield of sweet corn as influenced by interaction effect of levels and liquid organic manures.

Treatments	Nutrient levels (N)				Mean
	N_1	N_2	N_3	N_4	
	Liquid organic manures (L)				
L_1	15.0	14.8	13.0	7.0	**12.5**
L_2	14.6	14.4	13.0	7.0	**12.3**
L_3	15.9	15.0	13.9	7.2	**13.0**
L_4	12.1	12.0	11.5	5.6	**10.3**
Mean	**14.4**	**14.1**	**12.9**	**6.7**	
	N	**L**	**N×L**		
SEm±	**0.31**	**0.27**	**0.39**		
CD (P=0.05)	**0.76**	**0.67**	**0.81**		

Table 7: Green fodder yield of sweet corn as influenced by interaction effect of nutrient levels and liquid organic manures.

Treatments	Nutrient levels (N)				Mean
	N_1	N_2	N_3	N_4	
	Liquid organic manures (L)				
L_1	21.3	19.2	18.8	9.8	**17.3**
L_2	18.4	20.1	18.7	9.2	**16.6**
L_3	24.0	22.4	21.1	11.4	**19.7**
L_4	17.5	16.5	16.3	8.6	**14.7**
Mean	**20.3**	**19.5**	**18.7**	**9.7**	
	N	**L**	**N×L**		
SEm±	**0.2**	**0.44**	**0.82**		
CD (P=0.05)	**0.57**	**1.09**	**1.71**		

Conclusion

From the above results and discussion, it could be concluded that 125% RDN + cow urine resulted in highest growth attributes, yield attributes and yield of sweet corn. Moreover, 100% RDN + cow urine was found equally effective as and recorded statistically at par with the 125% RDN + cow urine treatment. It can be concluded that integration of 100% RDN through organic manures *i.e.* 1/3rd FYM + 1/3rdvermi compost + 1/3rd neem cake) and cow urine @ 200 litre ha^{-1} at 7 days interval through drip from 15 DAS could be recommended to increase the growth, yield attributes and yield of sweet corn.

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