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Research Article

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Effect of Different Levels of Irrigation, Nitrogen and Foliar Application of Banana Pseudostem Sap on Drip Irrigated Sweet Corn - Green Gram Cropping Sequence

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ABSTRACT

A field experiment was conducted during the rabi seasons of 2015-16 to 2017-18 at Soil and Water Management Research Unit farm, Navsari Agricultural University, Navsari to evaluate the effect of different levels of irrigation, nitrogen and foliar application of banana pseudostem sap on drip irrigated sweet corn and their residual effect on succeeding green gram under south Gujarat conditions. Significantly higher cob weight, no. of grains per cob and cob yield (16.6 t/ha) were recorded with I_2 (0.8 PEF) while significantly higher cob length, cob girth, cob weight, no. of grains per cob and cob yield (15.9 t/ha) were recorded with N_3 (140 kg N/ha). Application of banana pseudostem sap (S_2) significantly affected on cob weight, no. of grains per cob and cob yield as well as fresh fodder yield of sweet corn. Significantly higher cob yield (16.4 t/ha) of sweet corn was recorded with interaction between 120 kg N/ha (N_2) along with foliar application of banana pseudostem sap (S_2) @ 1 %. In succeeding green gram crop, higher grain yield was recorded with I_3N_3 (1 PEF along with 140 kg N/ha) and I_3S_2 (1 PEF and application of 1% banana pseudostem sap) in interaction effect. Treatment I_2 (0.8 PEF) recorded maximum sweet corn equivalent yield (18.55 t/ha), net returns (₹ 128440/ha) and B:C ratio (3.01), while an application of 140 kg N/ha (N_3) noted highest sweet corn equivalent yield (17.74 t/ha), net returns (₹ 122898/ha) and B:C ratio (2.87). Moreover, foliar application of banana pseudostem sap recorded highest sweet corn equivalent yield (17.12 t/ha), net returns (₹ 116741/ha) and B:C ratio (2.68) over control.

Keywords: *Banana pseudostem sap, Drip irrigation, Fertigation, Green gram, Nitrogen, Sweet corn.*

INTRODUCTION

Sweet corn (*Zea mays* L.) is a popular multi-purpose cereal crop. Corn ranks second to wheat based on the global cereal production. Corn is used for human consumption as both fresh and process product; it is also for livestock feeding and industrial uses. Sweet corn is generally cultivated for table purpose and its demand throughout the year.

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Water is scarce input and directly affects the growth and yield of corn. Irrigation especially through drip method reduces the water requirement for corn crop.

Nitrogen is another important input for crop production and requires more or less throughout the growth period. As nitrogen is mobile element, the time and rate of nitrogen application or nitrogen splitting with different quantity as per requirement of crop growth stage is most important for efficient utilization as well as for the maximization of crop yield.

Enriched banana pseudostem sap is one such natural product which contains plant nutrients and growth promoting substances like cytokinin and gibrellic acid. It also promotes the growth of crop and ultimate effect on production. Therefore, the present investigation was undertaken to evaluate the effect of different levels of irrigation, nitrogen and foliar application of banana sap on drip irrigated sweet corn - green gram cropping sequence.

MATERIALS AND METHODS

The present investigation was conducted at Soil and Water Management Research Unit, Navsari Agricultural University, Navsari during 2015-16 to 2017-18 *rabi* seasons with sweet corn variety Sugar-75 and green gram variety Meha. The experiment was laid out in split plot design replicated four times. The main plot treatments consisted of different drip irrigation and nitrogen levels, *viz*., 0.6 PEF, 0.8 PEF and 1.0 PEF and 100, 120 and 140 kg N/ha. However, sub plot treatments consisted of foliar applications of 1% banana pseudostem sap at 30 and 60 DAS and control. The soil was clay in texture, slightly alkaline (pH 7.9), normal electric conductivity (0.43 dS/m) with low in available Nitrogen (205 kg/ha), medium in available Phosphorus (40.1 kg/ha) and high in available Potassium (640 kg/ha). Sweet corn sown in at 60 x 20 cm and fertilized with 60 kg P_2O_5/ha and 40 kg K_2O/ha were applied as basal to all treatments, while application of nitrogen as per different treatments through fertigation. Nitrogen applied in forms of urea through fertigation in six equal splits at weekly intervals starting from 15 days after sowing. Green gram crop was sown in with 30 x 10 cm and fertilized with 20-40-00 kg NPK/ha. All the plant protection measures taken as per requirements. The experimental data collected during the course of investigation were statistically analyzed as per the procedure given by Gomez & Gomez (1984).

RESULTS AND DISCUSSION

Effect of irrigation

Three year pooled results of growth and yield attributes of sweet corn such as plant height, cob length, cob girth, cob weight and no. of grains per cob are presented in Table-1. Results revealed that parameters like cob weight and nos. of grains per cob were found significant due to different levels of irrigation. Significantly the highest cob weight and no. of grains per cob were recorded under irrigation level I_2 (0.8 PEF) of 355 g and 611 grains respectively as compared to rest of the irrigation levels. The increase in growth attributes under drip irrigation at 0.8 PEF might be due to enhanced availability and uptake of nutrients leading to enhanced photosynthesis, expansion of leaves and translocation of nutrients to reproductive parts. Similar findings were also recorded by Grieesha (2003).

The pooled data over 3 years of experimentation, data pertaining to cob yield and fresh fodder yield of sweet corn and grain as well as stover yield of green gram are given in Table-2. Result from Table-2 indicated that individual effect of different irrigation levels was found significant on cob yield and fresh fodder yield of sweet corn. Significantly highest sweet corn cob yield was reported with respect to irrigation level I_2 (16.6 t/ha) than other levels of irrigations, while in case of fresh fodder yield of sweet corn was recorded significantly higher with treatment I_3 (24.1 t/ha) as compared to other irrigation level. These might be due to that split application of nitrogen in drip irrigation coincided with the actual needs of the crop up to 80 days period and favoured good growth and produced maximum cob yield. Similarly, the placement of nutrients just near the base of plant became

quite useful as there was no leaching loss and the optimum soil moisture which was prevailing within crop root zone resulted in a better utilization of applied nutrients which ultimately gives higher yield. These results are confirmed with Singandhupe et al. (2003) and Tharmar & Pansdiain (2010).

Effect of nitrogen

Plant height was found non significant due to different levels of nitrogen. Whereas, significantly higher cob length (22.7 cm), cob girth (20.7 cm), cob weight (350 g) and nos. of grains per cob (614) were reported under N_3 (140 kg N/ha) but it was being at par with treatment N_2 (120 Kg N/ha) except cob length. Higher nutrient supplied more nutrients at peak uptake time without any nutrient stress. It was evidenced from the uptake pattern of maize crop for major nutrients. Uptake of the nutrients by maize crop was only up to 70-75 DAS and thereafter no uptake was noticed. Since maize is the nutrient responsive crop, it responded well to the applied higher nutrients in addition to native soil fertility which gives better results in growth and yield attributes of corn. The results are in agreement to Binder et al. (2000).

Treatment N_3 (140 kg N/ha) registered significantly higher cob yield (15.9 t/ha) as compared to N_1 (100 kg N/ha) (13.4 t/ha), but it was statistically at par with N_2 (120 kg N/ha) (Table-2). Different levels of nitrogen were failed to show any significant effect on fresh fodder yield of sweet corn as well as grain and stover yield of green gram. The increases in corn yield might be due to the increased utilization of N fertilizer in stimulating meristimatic activities. The accumulation of synthesized metabolites resulted in high dry matter accumulation and finally high grain weight. The obtained results are in good line with those reported by Agroudy (1986) and El-Sheikh (1993).

Effect of banana psuedostem sap

With respect to foliar application of banana psuedostem sap (BS), the parameters *viz*., plant height, cob length and cob girth were did not affect significantly (Table-1). Significantly higher cob weight (349 g) and no. of grains per cob (608) were obtained with respect to foliar spray of 1% banana psuedostem sap. Same treatment also registered significantly higher cob yield (15.2 t/ha) and fresh fodder yield of sweet corn (23.3 t/ha) as compared to without application. Foliar application of banana psuedostem sap did not affect significantly on grain and stover yield of green gram.

Interaction effect

Interaction effect of different levels of irrigation, nitrogen and banana psuedostem sap were not influenced significantly on growth as well as yield attributes of sweet corn.

Interaction effect due to different levels of irrigation, different levels of nitrogen and foliar spray of 1% banana psuedostem sap were failed to show any significant effect on fodder yield of sweet corn and green gram stover yield. In case of sweet corn yield, there was significant interaction observed between different levels of nitrogen and foliar application of banana psuedostem sap (Table-3). Significantly the highest yield recorded with 100 kg N/ha along with 1% banana psuedostem sap (N_2S_2) (16.4 t/ha) as compared to rest of the treatments, while lowest yield obtained under N_1S_1 (13.3.t/ha). In case of grain yield of green gram significant interaction effect were noticed with I x N and I x S in Table-4. Treatment combination I_3N_3 recorded significantly higher grain yield (681 kg/ha) which was statistically at par with I_3N_1 and I_1N_2. With respect to I x S, significantly higher green gram grain yield (644 kg/ha) was registered with treatment interaction I_3S_2 but it was remained at par with I_3S_1 and I_1S_2.

Sweet corn equivalent yield and economics

The maximum sweet corn equivalent yield (18.55 t/ha), net returns (₹ 128440/ha) and B:C ratio (3.01) obtained under I_2 (0.8 PEF) irrigation level, where as lowest yield under I_1 (0.6 PEF). Application of 140 kg N/ha (N_3) noted the highest sweet corn equivalent yield (17.74 t/ha), net returns (₹ 122898/ha) and B:C ratio (2.87), however the lowest recorded under N_1 (100 kg N/ha). Moreover, foliar application of banana pseudostem sap recorded the highest sweet corn equivalent yield (17.12 t/ha), net returns (₹ 116741/ha) and B:C ratio (2.68) over control.

Table 1: Growth and yield attributes of sweet corn as influenced by different treatments (Pooled over 3 years)

Treatments	Plant height (cm)	Cob length (cm)	Cob girth (cm)	Cob weight (g)	No. of grains/cob
Drip Irrigation, PEF (I)					
I_1 (0.6)	241.2	20.7	20.1	317	557
I_2 (0.8)	241.5	22.3	20.6	355	611
I_3 (1.0)	240.7	21.4	20.2	336	594
S.Em.±	0.57	0.60	0.17	4.20	5.03
CD @ 5 %	NS	NS	NS	11.8	14.2
Levels of nitrogen (N) kg/ha					
N_1 (100)	233.7	20.4	20.0	317	552
N_2 (120)	242.7	21.4	20.2	341	596
N_3 (140)	247.0	22.7	20.7	350	614
S.Em.±	3.42	0.35	0.18	2.79	7.97
CD @ 5 %	NS	1.13	0.58	9.10	24.9
CV %	11.9	11.9	10.2	11.0	10.0
Banana psuedostem sap					
S_1 (without)	240.0	20.6	20.2	323	567
S_2 (1 % sap)	242.3	22.1	20.4	349	608
S.Em.±	1.10	0.25	0.11	4.05	12.46
CD @ 5 %	NS	NS	NS	12	39
CV %	9.6	8.0	7.0	8.0	9.0
Signi. Int.	NS	NS	NS	NS	NS

Table 2: Grain and stover yield of sweet corn-green gram as well as equivalent yield of sweet corn and economics as influenced by different treatments. (Pooled over 3 years)

Treatments	Sweet corn cob yield (t/ha)	Sweet corn fresh fodder yield (t/ha)	Green gram grain yield (kg/ha)	Green gram Stover yield (kg/ha)	Sweet corn Equivalent yield (t/ha)	Net returns (₹/ha)	B:C ratio
Drip Irrigation, PEF (I)							
I_1 (0.6)	12.5	21.4	565	1345	14.25	92870	2.18
I_2 (0.8)	16.6	22.6	583	1332	18.55	128440	3.01
I_3 (1.0)	15.5	24.1	635	1387	17.46	121034	2.82
S.Em.±	0.25	0.35	15.90	38.01			
CD @ 5 %	0.70	0.98	NS	NS			
Levels of nitrogen (N) kg/ha							
N_1 (100)	13.4	21.5	565	1295	15.04	99426	2.34
N_2 (120)	15.4	22.8	603	1336	17.47	119940	2.81
N_3 (140)	15.9	23.8	615	1432	17.74	122898	2.87
S.Em.±	0.25	0.35	43.5	25.1			
CD @ 5 %	0.70	NS	NS	NS			
CV %	14.2	13.0	12.4	16.0			
Banana psuedostem sap							
S_1 (without)	14.6	22.1	572	1304	16.38	111495	2.67
S_2 (1 % sap)	15.2	23.3	617	1405	17.12	116741	2.68
S.Em.±	0.15	0.22	18.8	79.1			
CD @ 5 %	0.42	0.6	NS	NS			
CV %	10.52	10.1	12.1	9.0			
Signi. Int.	N x S	NS	I X N, I x S	NS			

Table 3: Interaction effect on cob yield of sweet corn (t/ha)

N x S	S_1	S_2
N_1	13.3	13.6
N_2	14.6	16.4
N_3	15.9	15.9
Mean	14.6	15.2
S.Em.±	0.12	
CD @ 5 %	0.35	

Table 4: Interaction effect on green gram grain yield (kg/ha)

I x N	N_1	N_2	N_3	I x S	S_1	S_2
I_1	495	640	560	I_1	517	613
I_2	545	600	604	I_2	570	595
I_3	655	570	681	I_3	627	644
Mean	565	603	615	**Mean**	572	617
S.Em.±	15.0			12.9		
CD @ 5 %	42.4			36.3		

CONCLUSION

From the three years pooled results of sweet corn equivalent yield and economics, it is concluded that for achieving higher yield and net profit from sweet corn-green gram cropping sequence, sweet corn crop is irrigated through drip at 0.8 PEF along with 120 kg N/ha applied through fertigation and 1 % foliar application of banana pseudostem sap at 30 and 60 DAS. For getting additional benefit, succeeding green gram crop taken after harvesting of sweet corn.

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