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Effect of fertility levels and weed management practices on weed dynamics and yield potential of spring planted sugarcane

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ABSTRACT

An experiment was conducted to study the effect of fertility levels and weed management practices on weed dynamics, fertility status and yield potential of spring planted sugarcane at C.C.R. (P.G.) College, Muzaffarnagar, Uttar Pradesh during 2007-08 and 2008-09. Results revealed that levels of fertilizer did not affect the weed population and dry matter accumulation while, the yield and yield attributes of sugarcane were improved remarkably. Highest mean cane yield of 88.3 t/ha and commercial cane sugar (CCS) yield of 11.1 t/ha was recorded when crop received 125% of recommended dose of fertilizers being 15.8 and 29.0% higher over 75% recommended dose of fertilizers. Among the weed management options, application of glyphosate @ 1.0 kg at 25 days after planting + one hoeing at 60 DAP proved superior over controlling the weed population and dry matter production as indicated by higher weed control efficiency, cane and CCS yield with lowest weed index in spring planted sugarcane. However, a reverse trend in residual soil fertility status was observed in relation to the treatments produced higher cane yield which was removed more nutrients from soil.

Key words: Sugarcane, Cane yield, CCS, NPK levels, Soil fertility, Weed control

Sugarcane is an important commercial crop in subtropical India being cultivated on 5.08 mha with an average productivity of 68.4 t/ha. Heavy infestation of weeds comprising of grasses, broad-leaved weeds and sedges poses a big challenge for sugarcane production. Initial slow growth and wider row spacing in sugarcane provides ample opportunity for weeds to easily occupy vacant spaces between rows and offer serious competition to sugarcane. Besides, good sunshine and intermittent rains during early monsoon provides congenial environment for excessive growth of weeds. Negligent attitude of farmers towards weeds often aggravates the losses due to weeds that range from 40% reduction in cane yield to total crop failure depending on the spectrum of weeds, planting season, soil type, rainfall, and duration and time of weed competition. Nutrient management is an important factor for increasing yields. However, positive effect of fertilizers can be harnessed successfully only with effective control of weeds. Escalating prices of fertilizers in the market has become a cause of concern so as to sustain theproductivity of the crop. Considering these facts, the present investigation was conducted to evaluate different fertility levels and weed management practices in spring planted sugarcane.

MATERIALS AND METHODS

A field experiment on spring planted sugarcane was conducted during 2007-08 and 2008-09 at Research Farm of Chaudhary Chhotu Ram Post-Graduate College, Muzaffarnagar. The soil was sandy loam in texture, pH 7.5, low in organic carbon (0.48%) and available N (156 kg/ha) while medium in available phosphorus (15.2 kg/ha) and potassium (203 kg/ha). Twenty one treatments comprising of the combinations of 03 fertility levels i.e. 75%, 100% and 125% of recommended dose of NPK (150:60:60 kg NPK/ha) and 07 weed management options (weedy check; weed free; three hoeing at 30, 60 and 90 days after planting (DAP); one hoeing at 30 DAP followed by atrazine @ 2.0 kg a.i./ha; atrazine @ 2.0 kg a.i./ha as pre-emergence spray + 2, 4-D @ 1.0 kg a.i./ha 60 DAP; glyphosate @ 1.0 kg a.i./ha at 25 DAP + one hoeing at 60 DAP and *Sesbania* sowing in inter row spaces followed by 2,4-D @ 1.0 kg a.i./ha at 45 DAP were tested in factorial randomized block design with three replications. Sugarcane 'CoS 97264' was planted in 2nd fortnight of March during both the years. Nitrogen, phosphorus and potassium were supplied through urea, single super phosphate and murate of potash, respectively. The crop was fertilized as per treatments. Half of the nitrogen was applied as basal and remaining half was top dressed in two equal splits at 45 and 75 DAP stage, irrespective of the treatments. Full phosphorus and potassium were given as basal. Among the weed control practices, all the herbicides were applied as solution in water (at the rate of 700 liters/ha). The herbicide solutions were sprayed uniformly in the experimental plots, as per treatments with the help of Knapsack sprayer. Available nitrogen, phosphorus and potassium were determined by the methods described by the Subbiah and Asija (1956), Olsen *et*

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al. (1954) and Jackson (1973), respectively. The crop was raised with standard package of practices. The trend of results was similar during 2007-08 and 2008-09 hence, data were subjected to pooled analysis for results and discussion.

RESULTS AND DISCUSSION

Effect on weeds

The weed flora in the experimental field consisted of *Cyperus rotundus* L., *Cynodon dactylon, Sorghum halepense, Cleome viscosa, Corchorus acutangulus, Cucumis trigonus, Eleusine indica, Brachiaria mutica, Euphorbia hirta, Phyllanthus niruri* and *Physalis minima*. The population of *Cyperus rotundus* L., *Cynodon dactylon, Sorghum halepense and Cleome viscosa* contributed more than 62 per cent of the total weed density. The weeds *Corchorus acutangulus, Cucumis trigonus, Eleusine indica, Brachiaria mutica, Euphorbia hirta, Phyllanthus niruri* and *Physalis minima* were found in very low density in all the treatments. Large variability in weed flora of sugarcane has also been reported by Singh *et al. (*2005).

Population density of *Cyperus rotundus* L., *Cynodon dactylon, Sorghum halepense* and other weeds was not influenced by different levels of NPK applied to sugarcane. All weed control measures reduced the weed population significantly as compared with weedy check (Table 1). The lowest weed density (10.93/m^2) was recorded under the treatment of three hoeing (30, 60 and 90 DAP). It was found at par with glyphosate (1.0 kg a.i./ha at 25 DAP) + one hoeing at 60 DAP (11.28/m^2) and followed by one hoeing at 30 DAP + atrazine @ 2.0 kg a.i./ha (11.44/m^2) . None of the treatments could match with weed free conditions. Sowing of *Sesbania* in inter- row spaces followed by 2,4-D @ 1.0 kg a.i./ha failed to suppress the growth of weeds and therefore recorded the highest (12.46/m^2) weed population. Treatments involving three hoeings or glyphosate + one hoeing at 60 DAP caused continuous decline in total weed population as well as individual populations of *Cyperus rotundus, Cynodon dactylon* and *Sorghum halepense* with advancement of crop age upto 120 days. It might be attributed to suppression of germination of other weeds by hoeing at 60 DAP. The results are corroborated with the findings of Raskar (2004).

Dry matter accumulation

Dry matter accumulation in weeds did not varied by fertility levels. Total dry weight of weeds showed significant variation owing to weed control measures. The total weed dry matter accumulation was recorded highest (19.46 g/m^2) under weedy check conditions at 120 DAP and after that it was declined in all the weed control measures. Application of glyphosate at

Table 1 Effect of fertility levels and weed control options on weed density and total weed dry weight (Pooled over two years) at 120 days after planting stage in sugarcane

Treatment	Weed density (number/m^2)					Total weed dry weight (g/m^2)	Weed control efficiency (%)
	Cyperus rotundus	*Cynodon dactylon*	*Sorghum halepense*	Others	Total	Total	
Fertilizer dose							
75 % of RDF	8.09	5.13	4.40	3.55	11.19	9.35	-
100 % of RDF	7.74	5.00	4.27	4.02	10.97	9.49	-
125 % of RDF	7.66	4.98	4.20	4.09	10.92	9.54	-
SEm±	0.09	0.06	0.06	0.05	0.10	0.09	-
CD (P = 0.05)	NS	NS	NS	NS	NS	NS	-
Weed control measure							
Weedy check	13.34	9.29	7.79	5.31	18.81	19.46	-
Weed free	0.00	0.00	0.00	0.00	0.00	0.00	-
Three hoeing at 30, 60 and 90 DAP	6.96	4.84	3.29	4.29	10.93	8.33	57.20
One hoeing at 30 DAP followed by Atrazine @ 2.0 kg a.i./ha	7.95	5.46	4.39	4.30	11.44	10.14	47.89
Atrazine @ 2.0 kg a.i./ha as Pre-E+2,4-D @ 1.0 kg a.i./ha 60 DAP	9.41	5.04	4.87	4.14	12.26	11.27	42.09
Glyphosate @ 1.0 kg a.i./ha 25 DAP + one hoeing at 60 DAP	7.63	4.50	4.35	4.46	11.28	7.03	63.87
Sesbania in inter row space followed by 2,4-D spray at 45 DAP	9.52	6.64	5.34	4.72	12.46	10.00	48.61
SEm±	**0.15**	**0.09**	**0.09**	**0.07**	**0.17**	**0.15**	**1.36**
CD (P = 0.05)	**0.43**	**0.27**	**0.25**	**0.21**	**0.49**	**0.43**	**3.92**

RDF= recommended dose of fertilizers , DAP= days after planting

1.0 kg a.i./ha + one hoeing recorded minimum dry matter of weeds followed by three hoeing at 30, 60, 90 DAP and one hoeing at 30 DAP + atrazine @ 2.0 kg a.i./ha than other weed control measures. Reduction in weed dry matter attributed to repeated weeding and 3 hoeings has also been reported by Singh and Lal (2008). Weed control efficiency (an index to reduction in weed dry matter) at 120 DAP was recorded highest (63.9%) with glyphosate @ 1.0 kg a.i./ha (25 DAP) + one hoeing (60 DAP) followed by the treatment comprising three hoeing (57.2%). Sathyavelu *et al.* (1999) also recorded highest weed control efficiency with glyphosate application in sugarcane.

Effect on sugarcane

The highest number of shoots at 120 DAP (163.7 thousand/ha) were recorded at 125% of recommended dose which was at par with 100% recommended dose of fertilizers. The lowest number of shoots (154.3 thousand/ha) was recorded under 75% recommended dose of NPK. All the weed control measures led to an improvement in tillering of crop though the superiority was established by weed free, glyphosate @ 1.0 kg a.i./ha at 25 DAP + one hoeing at 60 DAP and one hoeing at 30 DAP followed by atrazine @ 2.0 kg a.i./ha and three hoeing at 30, 60 and 90 DAP. Accordingly, the highest shoot population (183.6 thousands/ha) was recorded under weed free conditions, though it was on par with glyphosate @ 1.0 kg a.i./ha at 25 DAP + one hoeing at 60 DAP (175.8 thousans/ha) and followed by three hoeings at 30, 60 and 90 DAP (167.2 thousands/ha). Singh and Lal (2008) also observed highest number of shoots in manually hoeing plots.

Yield and yield attributes

Graded doses of NPK application had significant impact on number of millable canes, cane length, individual cane weight, cane yield and commercial cane sugar (CCS) yield (Table 2). Among the doses, 125% of RDF application to sugarcane produced higher number of millable cane (110.1x 10^3), individual cane weight (818g), cane yield (88.0 t/ha) and commercial cane sugar yield of 11.1 t/ha. This might be due to increase in the availability of plant nutrients as a result of this, the fertility status of the soil might have increased which increased the absorption of plant nutrients. Enhanced tillering

Table 2 Effect of fertility levels and weed control options on growth, yield and yield attributes of sugarcane and residual soil fertility after harvest of crop (Pooled over two years).

Treatment	Germination (%)	Shoot population (000/ha)	NMC (000/ ha)	Cane length (cm)	Cane weight (g)	Cane yield (t/ha)	CCS yield (t/ha)	Weed index (%)	Residual soil fertility (kg/ha)		
Fertilizer doses (150:60:60 kg/ha of N:P_2O_5 :K_2O)									N	P	K
75 % of RDF	35.53	154.3	90.0	247.7	709	76.2	8.6	-	136	14.6	240
100 % of RDF (150:60:60 kg/ha)	35.97	160.6	108.0	265.2	799	85.0	10.4	-	129	13.6	228
125 % of RDF	36.23	163.7	110.1	277.4	818	88.3	11.1	-	127	13.0	226
SEm±	**0.30**	**1.2**	**1.1**	**1.2**	**3**	**0.8**	**0.1**	**-**	**1.2**	**0.3**	**2.6**
CD (P = 0.05)	**NS**	**4.9**	**4.3**	**4.8**	**12**	**3.2**	**0.3**	**-**	**3.5**	**1.0**	**8.4**
Weed control measures								-			
Weedy check	34.67	134.5	74.9	241.3	663	60.1	7.2	38.4	144	14.6	240
Weed free	35.95	183.6	125.9	283.4	826	97.5	12.0	-	122	12.8	223
Three hoeing at 30, 60 and 90 DAP	36.19	167.2	110.6	269.8	803	89.6	11.0	8.1	124	12.9	220
One hoeing at 30 DAP followed by Atrazine @ 2.0 kg a.i./ha	36.53	163.4	102.1	262.5	779	84.2	10.1	13.6	133	13.6	228
Atrazine @ 2.0 kg a.i./ha as Pre-E+2,4-D @ 1.0 kg a.i./ha at 60 DAP	37.14	151.0	87.3	253.7	758	78.6	9.3	19.4	134	13.7	238
Glyphosate @ 1.0 kg a.i./ha at 25 DAP + one hoeing at 60 DAP	36.29	175.8	116.0	276.1	819	90.1	11.0	7.6	136	14.6	240
Sesbania in inter row space followed by 2,4-D spray at 45 DAP	35.00	141.1	91.6	257.2	781	81.4	9.7	16.5	129	13.6	228
SEm±	**0.44**	**3.0**	**1.8**	**4.8**	**14**	**1.6**	**0.2**	**0.5**	**127**	**13.0**	**226**
CD (P = 0.05)	**1.27**	**8.7**	**5.2**	**13.9**	**41**	**4.7**	**0.5**	**1.4**	**1.2**	**0.3**	**2.6**

recorded under this treatment must also have contributed to the yield. The lowest yield and yield contributing characters were observed under lowest fertility levels. The results are in agreement with the findings of Virida and Patel (2010).

The highest cane and commercial cane sugar yield (97.5 and 12.0 t/ha) was recorded under weed free conditions which was significantly higher over other treatments. It was followed by the glyphosate @ 1.0 kg a.i./ha + one hoeing at 60 DAP (90.1 and 11.0 t/ha) being at par with three hoeing at 30, 60 and 90 DAP. The higher yield obtained under these treatments might be due to higher yield attributes i.e. number of millable canes and individual cane weight. Profuse tiller production and low shoot mortality might have helped in realizing higher number of millable canes by virtue of reduced competition of weeds for nutrient, moisture and light. Srivastava and Chauhan (2006) also noticed an increase in number of millable canes with application of glyphosate. Weed index (yield reduction in treatment as compare to weed free condition) varied significantly owing to weed control measures. The lowest weed index (7.6 %) was recorded when the crop was sprayed with glyphosate @ 1.0 kg a.i./ha at 25 DAP followed by one hoeing at 60 DAP and it was closely followed by three hoeings at 30, 60 and 90 days after planting stage (8.1%). Maximum yield reduction (38.4%) was observed under weedy check followed by atrazine @ 2.0 kg a.i./ha as Pre-E+2,4-D @ 1.0 kg a.i./ha at 60 DAP (19.4%), *Sesbania* in inter row space followed by 2,4-D spray at 45 DAP (16.5%) and one hoeing at 30 DAP followed by atrazine @ 2.0 kg a.i./ha (13.6%), respectively. The lower weed index recorded under these treatments might be due to effective control of weeds which resulted into enhancement of cane yield. The results are in conformity with the findings of Ramana *et al.* (2007).

Soil fertility status

Fertilizer application had significant effect on nutrient status of the soil at harvest of sugarcane (Table 3). Crop fertilized with 75% of recommended NPK dose recorded more residual fertility (N 136, P 14.6 and K 240 kg/ha) being significantly higher by 9.0, 1.6 and 14.0 kg/ha over 125% NPK levels. This higher status of the nutrients in soil at harvest of the sugarcane might be due to low cane yield with less removal of nutrients which directly maintained the residual fertility of soil.

Residual soil fertility status of N, P and K were ranged from 122 to 144, 12.8 to 14.6 and 220 to 240 kg /ha, respectively under various weed control measures adopted. Among the weed control options, highest residual soil fertility (N 144, P 14.6 and K 240 kg/ha) was recorded with weedy check conditions being significantly higher by 22, 1.8 and 17 kg/ha when compared to weed free situation. The treatments one hoeing at 30 DAP followed by atrazine @ 2.0 kg a.i./ha, atrazine @ 2.0 kg a.i./ha as Pre-E+2,4-D @ 1.0 kg a.i./ha at 60 DAP and *Sesbania* in inter row space followed by 2,4-D spray at 45 DAP recorded higher nutrient status among the herbicidal treatments which attributed to lower removal of the nutrients by low cane yield.

Thus, it is concluded that application of 125% RDF improved the growth, yield attributes, cane yield and commercial cane sugar yield over lower doses of fertilizers. Among the weed control treatments, the weed free followed by glyphosate @ 1.0 kg a.i./ha at 25 DAP + one hoeing at 60 DAP and 3 hoeing at 30, 60 and 90 days after planting were superior in controlling weeds and improving growth, yield characters and yields (numbers of millable canes/ha, commercial cane sugar and cane yields) of spring planted sugarcane.

REFERENCES

Jakson M L. 1973. *Soil Chemical Analysis*. Prentice Hall of India Pvt. Ltd, New Delhi.

Olsen S R, Cole C V, Watanabe F S and Dean L A. 1954. Estimation of available phosphorus in soil by extraction with sodium bicarbonate. *USDA Circulur* No. 939.

Ramana A V, Naidu G J and Ramana Murthy K V. 2007. Integrated weed management in rainfed upland rice (*Orzya sativa* L.). *Indian Journal of Agronomy* **52**: 311-4.

Raskar B S. 2004. Evaluation of herbicides for weed control in sugarcane. *Sugar Technology* **6**: 173-5.

Singh R, Sen D, Singh V K, Rana N S and Kumar S. 2005. Effect of weed management practices on spring planted sugarcane and associated weeds. *Indian Journal of Agronomy* **50**: 236-8.

Sathyavelu A, Chandaragiri K K, Ahmed S N, Umapathy G and Giridharan S. 1999. Influence of the management of *Cyperus rotundus* (nut sedge) on sugarcane yield and quality. *Indian Sugar* **49**: 483-6.

Singh A K and Menhi Lal 2008. Weed management in spring planted sugarcane (*Saccharum spp*. hybrid) based intercropping systems. *Indian Journal of Agricultural Sciences* **78**: 35-9.

Srivastava T K and Chauhan R S. 2006. Weed dynamics and control of weeds in relation to management practices under sugarcane (*Saccharum species* complex hybrid) multi-ratooning system. *Indian Journal of Agronomy* **51**: 228-31.

Subbiah B V and Asija G L. 1956. A rapid procedure for estimation of available nitrogen in soil. *Current Science* **25**: 259-60.

Virida H M and Patel C L. 2010. Integrated nutrient management for sugarcane (*Saccharum* spp. hybrid complex) plant –ratoon system. *Indian Journal of Agronomy* **55**: 147-51.