ISSN: 2319-9482

International Journal of Current Agricultural Research, Vol. 5, No. 06, PP.221-223, June 2017

http://www.journalagri.com

IJCAR

Full Length Research Article

SUCKER PRODUCTION POTENTIAL OF SISAL (*AGAVE SISALANA* PERR. EX ENGELM.) AS INFLUENCED BY DRIP-IRRIGATION, MANURE AND FERTILIZERS

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Accepted 09th February, 2017; Published 30th June, 2017

Field experiment conducted during 2006-07 to 2010-11 at Sisal Research Station (22.041°N, 84.295°E, 267 m AMSL), Bamra, Odisha, India to study the effect of irrigation (drip), manure and fertilizers on the sucker production capacity in sisal (*Agave sisalana* Perr. Ex Engelm.). It was found that application of drip irrigation (with discharge rate of 4 l/hr for 2 hrs at 2 weeks interval during 1 April-15 June), manure (FYM @ 5t/ha) and fertilizers ($N_{60}P_{30}K_{60}$ or $N_{120}P_{30}K_{60}$ kg/ha) could produce 23.4-24.2 thousand suckers/ha in 4th crop year and 8.7-9.3 thousand suckers/ha in 5th crop year. A well-managed sisal plantation thus could produce 32.1-33.5 thousand suckers/ha in 2 years at the later phase of sisal plantation, which is sufficient to plant 7 ha new plantation. The quantum of sucker produced adds farmer's income by about Rs.1,31,200/ha from disposal of the suckers as sisal planting material.

Key words: Sisal, Agave sisalana, Sucker production, Drip-irrigation, Manure, Fertilizer.

INTRODUCTION

Sisal (*Agave*sp), a xerophyte of Aaparagaceae family, from which commercial hard fibre is produced from its sword like mature long leaf (80-150 cm). Different species of Agaves namely *A. sisalana*, *A. cantala*, *A. vera-cruz*, *A. amaniensis*, *A. angustifolia*, *A. fourcryodes* and some more are cultivated. However, among the different species, *A. sisalana* contributes nearly 85% of the total sisal fibre production of the World. In India sisal is cultivated in the central plateau zone comprising major part of western Odisha, Jharkhand, Chhattisgarh, and in scattered areas of Maharashtra, Andhra Pradesh and Karnataka (Sarkar, 2015). In Indian condition seed is not produced in sisal and therefore, the crop is propagated through vegetative means namely bulbils and suckers. Bulbils are small plantlets with 2-3 small leaves produced on the flowering stalk of mature sisal plant once in 8-10 years or so. Bulbils are so tiny that it require extra care in nurseries for about a year and then it can be used as planting material in the main field of sisal. Whereas, suckers are bigger sized plantlets produced from the roots of sisal plant after 3-4 years of active growth. Suckers are big enough and are used as propagating material for developing new plantation or gap filling in existing sisal plantation (Sarkar *et al*., 2010). There is no significant difference in growth and yield of sisal if grown from mature bulbils or suckers of similar size. Therefore, choice of propagating material would be either one as per availability in the locality (Dhyani and Geo Paul, 1974). It was reported that planting by bulbils caused 9% mortality and planting from suckers caused minimum mortality of the sisal plantlets (Reddy, 1966). However, there is no study to quantify the numbers of suckers are produced from a healthy sisal plantation and at the same time no information is available for effect of irrigation, manure and fertilizer application on sucker production capability of sisal. Such information is vital for planning new sisal plantation or area expansion from an existing sisal plantation/ estate.

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Therefore, a field experiment was conducted to study the effect of irrigation, manure and fertilizers on sucker production capability in sisal (*Agave sisalana* Perr. Ex Engelm.).

MATERIALS AND METHODS

A field experiment was conducted for 5 consecutive years during 2006-07 to 2010-11 at the Sisal Research Station (located at 22.041°N, 84.295°E, 267 m AMSL) a regional research station of ICAR-CRIJAF), at Bamra, in Sambalpur district of Odisha to study the effect of irrigation (drip), manure and fertilizers on the sucker producing capability in sisal (*Agave sisalana*Perr. Ex Engelm.). The experiment soil was acidic in reaction pH (1:2.5 w/v) in water 5.22, low in organic carbon 3.3 g/kg, having available nitrogen of 189 kg/ha, available phosphorus of 32.4 kg/ha and available potassium of 115.7 kg/ha. The experiment was laid in 3 factor split plot design with 2 levels of irrigation (I_0= no irrigation; I_1: drip irrigation with discharge rate of 4 l/hr for 2 hours at 2 weeks intervalduring 1 April to 15 June) in main plot, 2 levels of manure (M_0= no manure, M_1= FYM @ 5t/ha) in sub plot and 4 levels of chemical fertilizers [N_0= no fertilizer, N_1=$N_0P_{30}K_{60}$, N_2= $N_{60}P_{30}K_{60}$ (recommended dose), N_3= $N_{120}P_{30}K_{60}$] in sub-sub plots with individual plot size of 8 m x 6 m replicated thrice. Sisal suckers were planted in the recommended double row planting system [(1m x 1m) x 3 m] during July 2006. All other recommended agronomic practices were followed to raise the experimental sisal plantation. The suckers were started appearing late in 2008 and the number of suckers were counted and removed from the field once on 15th September in 2009 (sucker collection year-I) and again on 11th August 2010 (sucker collection year-II). Thereafter, the sucker production from the field was irregular & meagre and therefore, the data was not considered for analysis. So the two years data on sucker production were processed and analysed by following standard statistical procedure (Panse and Sukhatme, 1995).

Table 1. Effect of irrigation, manure and fertilizers on sucker production capacity ('000/ha) in sisal

		Sucker collection year-I				Sucker collection year-II			
		N_0	N_1	N_2	N_3	N_0	N_1	N_2	N_3
I_0	M_0	6.18	7.92	14.79	16.11	3.61	4.51	5.42	6.32
	M_1	7.99	10.90	16.04	17.92	4.65	5.21	6.04	7.01
I_1	M_0	9.79	15.42	21.18	22.09	5.49	7.01	7.78	8.33
	M_1	15.00	17.50	23.40	24.17	6.95	7.85	8.75	9.31
CD (IxMxN)			0.753				NS		

Table 2. Interaction effect between irrigation and manureon sucker production capacity ('000/ha) in sisal

	Sucker collection year-I			Sucker collection year-II		
	M_0	M_1	Mean	M_0	M_1	Mean
I_0	11.25	13.21	12.23	4.97	5.73	5.35
I_1	17.12	20.02	18.57	7.15	8.21	7.68
Mean	14.18	16.61	-	6.06	6.97	-
CD 5%	0.266		0.707	0.094		0.137
CD (I x M)	0.376			0.133		

Table 3. Interaction effect between irrigation and fertilizers on sucker production capacity ('000/ha) in sisal

	Sucker collection year-I					Sucker collection year-II				
	N_0	N_1	N_2	N_3	Mean	N_0	N_1	N_2	N_3	Mean
I_0	7.08	9.41	15.42	17.02	12.23	4.13	4.86	5.73	6.67	5.35
I_1	12.40	16.46	22.29	23.13	18.57	6.22	7.43	8.26	8.82	7.68
Mean	9.74	12.93	18.85	20.07	-	5.17	6.15	7.00	7.74	-
CD		0.376			0.707		0.133			0.137
CD (I x N)		0.532					0.188			

Table 4. Interaction effect between manure and fertilizers on sucker production capacity ('000/ha) in sisal

	Sucker collection year-I					Sucker collection year-II				
	N_0	N_1	N_2	N_3	Mean	N_0	N_1	N_2	N_3	Mean
M_0	7.99	11.67	17.99	19.10	14.18	4.55	5.76	6.60	7.33	6.06
M_1	11.49	14.20	19.72	21.04	16.61	5.80	6.53	7.39	8.16	6.97
Mean	9.74	12.93	18.85	20.07	-	5.17	6.15	7.00	7.74	-
CD		0.376			0.266		0.133			0.094
CD (M x N)		0.532					0.188			

RESULTS AND DISCUSSION

Effect of irrigation, manure and fertilizers on sisal suckers production

Sucker production capacity of sisal was positively affected by the applied irrigation, manure and fertilizer (Table 1). In the 1st year of observation (4thcrop year), the interaction effect among the 3 factors on the number of suckers produced was statistically significant. The highest number of suckers produced (24.17 thousand/ha) was recorded with drip irrigation (I_1), manure (M_1) and the highest level of fertilizers (N_3). In contrast, the lowest number of suckers was produced (6.18 thousand/ha) where no irrigation, manure and fertilizer were applied.

Interaction effect between irrigation and manure on sisal sucker production

In both the years of observations, the interaction effect between irrigation and manure on the number of sisal sucker production were significant (Table 2). In the 1st year of observation, irrespective of manure level, irrigation produced the maximum number of sisal suckers (18.57 thousand/ha) which is 51.8% more number of sisal suckers as compared to no irrigation. Application of manure also exerted influence on number of sucker production. Irrespective of irrigation level, the maximum number of suckers (16.61 thousand/ha) was produced in case of manure application. However, the increase in number of suckers for manure application was only 17.1% more as compared to no manuring. In the 2nd year of record, it was observed that irrigation produced the maximum number of suckers (7.68 thousand/ha) which is at least 43.5% more number of suckers as compared to no irrigation. Similarly, application of manure also increased the number of sucker production by 15% as compared to no manuring.

Interaction effect between irrigation and fertilizers on sisal sucker production

Interaction effect of irrigation and fertilizers on sucker production capacity in sisal were significant in both the year of observation (Table 3). In the 1st year of sucker collection, irrespective of irrigation level, the maximum number of suckers (20.07 thousand/ha) were produced with highest level of fertilizer (N_3), although that was just 6.5% more as compared to lower level of fertilizer (N_2) application (18.85 thousand/ha). Application of fertilizer in recommended doses (N_2) could able to produce 93.5% more number of suckers as compared to no fertilizer application (9.74 thousand/ha). Interestingly, it was observed that addition of nitrogenous fertiliser (N_2 level) produced 45.8% more number of suckers as compared to the fertilizer level (N_1) with only P and K fertilizer (12.93 thousand/ha). In the 2nd year of sucker record also, similar effects on sisal sucker production were observed. Recommended doses of fertilizer (N_2) could produce 35.4% more suckers as compared to no fertilizer application (5.17 thousand/ha).

Interaction effect of manure and fertilizers on sucker production

In both the year of observation, the interaction effect of manure and fertilizer on sisal sucker production were significant (Table 4). Irrespective of fertilizer level, manure application produced 17.1% more number of suckers as compared to no manuring (14.18 thousand/ha). In 2nd year of observation, the increase in sucker production was 15% more as compared to no manuring (6.06 thousand/ha). It was also recorded that in the 2nd year of sucker collection, the number of sucker production was 58% less as compared to earlier year (16.61 thousand/ha).

Conclusion

It may be concluded that application of irrigation (drip), manure and fertilizers exerted positive effect on sucker production capacity in sisal. Drip irrigation (4 l/hr for 2 hrs at 2 weeks interval during 1 April to 15 June), addition of manure (FYM @ 5 t/ha) and application of fertilizers ($N_{60}P_{30}K_{60}$ or $N_{120}P_{30}K_{60}$) to sisal could produce huge number of suckers (23.4 to 24.2 thousand/ha) in the 1st sucker uprooting year (4th crop year) and also quite good number of suckers (8.7 to 9.3 thousand/ha) in the next year (5th crop year). So, for 2 years, the total sucker production will be 32.1 to 33.5 thousand/ha which is sufficient to cover about 7 ha (@ 5000 suckers/ha) of new sisal plantation. Moreover, the produced suckers could add farmer's income by about Rs.1,31,200/- (@ □4,000 per thousand at present) if sold as planting material to other sisal farmers.

Acknowledgement

The authors express sincere thanks to the Director, ICAR-CRIJAF, Barrack pore, Kolkata for permitting to conduct the study and also thankful to the Scientist-in-Charge of Sisal Research Station for providing all physical facilities required for the field experiment. Thanks are also due to Sk Abdullah, R.S. Toppo and M.K Pradhan, Technical Officers of Sisal Research Station, Bamra, Sambalpur, Odisha for their untiring efforts to manage the experiment and meticulous collection of field data.

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