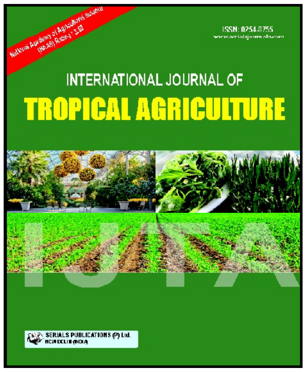

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"Economics of Finger Millet (*Eleusine coracana* L. Gaertn.) Influenced Due to Different Establishment Techniques, Levels and Time of Application of Nitrogen"

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Abstract: A field experiment was conducted to study the economics of finger millet (*Eleusine coracana* L. Gaertn) influenced due to different establishment techniques, levels and time of application of nitrogen. The field experiment was laid out in split-split plot design with 48 treatments and three replications. Total number of 48 treatments consist of four techniques of establishment as main plot (**T_1**-Recommended transplanting at 20X15 cm, **T_2**-Random transplanting, **T_3**-Random broadcasting of 30 days old seedling (*Awatni*), **T_4-**Random broadcasting of 20 days old seedling (*Awatni*)), three nitrogen levels in sub plot (**F_1**-60 kg N ha^{-1}, **F_2**-80 kg N ha^{-1}, **F3-**100 kg N ha^{-1}) and four times of nitrogen application as sub-sub plot (**S_0**-Basal- (half dose through suphala (15:15:15))**,** **S_1**-2 Split- TP, 30 DAT, **S_2**-3 Split- TP, 30 DAT, 60 DAT, **S_3**-4 Split- TP, 20 DAT, 40 DAT, 60 DAT). The results of investigation clearly showed that finger millet crop established by recommended transplanting and 100 kg nitrogen per hectare with 3 splits of nitrogen application (at transplanting (TP), 30 and 60 DAT) gave higher returns, net returns and B:C ratio.

Key words: Economics, Establishment techniques, Nitrogen levels, Time of application, Finger millet)

INTRODUCTION

Millets are the most important cereals of the semi-arid zones of the world. Among millet crops, finger millet ranks fourth in importance after sorghum, pearl millet and foxtail millet. It is an important staple crop in many parts of Eastern and Southern Africa, as well as in South Asia. It is grown globally on more than 4 million hectares and is the primary food source for millions of people in tropical dryland regions. With a total production of 5 million tonnes of grains, of which India alone produces about 2.2 million tonnes and Africa about 2 million tonnes. Finger millet contributes nearly 40 per cent of small millets of India, occupying an area of 1.27 million ha with average annual production 1.89 million tonnes with productivity 1489 kg ha^{-1} in 2009-10 (Rajendra Prasad, 2012).

In Maharashtra, finger millet occupies an area of about 120 thousand ha with an annual grain production of 109 thousand tonnes with productivity 908 kg ha^{-1} in 2009-10 (Rajendra Prasad, 2012). It is mainly cultivated in Thane, Raigad, Ratnagiri, Sindhudurg, Dhule, Jalgaon, Nashik, Ahmednagar, Pune, Satara and Kolhapur districts. The main reasons of low productivity and profitability are mainly viz., vagaries of nature, lower fertilizer dose, poor crop management, less fertilizer use efficiency and adherence of farmers to traditional crop management practices.

To get higher yield of finger millet, new high yielding fertilizer responsive varieties should be adopted with proper nutrient management practices. The productivity is low due to delay in nursery sowing and late transplanting, faulty methods of cultivation and little or no use of fertilizers. The secret of boosting its yields mainly lies in timely transplanting and properly fertilizing the crop.

The key to enhance fertilizer use efficiency is to synchronize the time of fertilizer application with the growth need of the crop and period of high root activity. It is useful to increase the number of split applications provided the cost of application is not prohibited. In cereal crops, it is best to apply fertilizers prior to flowering that helps for increasing fertilizer use efficiency and reduces fertilizer losses. Top dressing can be done in several stages to reduce nutrient losses. Therefore, it is usually best to divide the total fertilizer N into a series of applications, called split applications. Split application allows us to apply nutrients as and when needed. *Konkan* is major finger millet growing tract of Maharashtra. There is wide scope to increase the yield potential of *nagli* by using appropriate production technology.

Therefore, such technologies are to be developed which are possible to use even by the poor farmers to improve their crops yield. In view of the above, the investigation "Economics of finger millet (*Eleusine coracana* L. Gaertn.) influenced due to different establishment techniques, levels and time of application of nitrogen" was planned, keeping four techniques of establishment i.e. recommended transplanting, random transplanting and random broadcasting of 20 and 30 days old seedlings with three levels of nitrogen i.e., 60, 80 and 100 kg N per hectare and four times of nitrogen application i.e. basal dose, two split, three split and four split of nitrogen application under high rainfall area of South *Konkan*.

MATERIAL AND METHODS

A field experiment was conducted during Kharif season 2011 and 2012 at Research farm, Department of Agronomy, College of Agriculture, Dapoli, Dist. Ratnagiri (M.S.) to study the economics of finger millet (*Eleusine coracana* L. Gaertn.) influenced due to different establishment techniques, levels and time of application of nitrogen. The field experiment was laid out in split-split plot design with 48 treatments and three replications. Total number of 48 treatments consist of four techniques of establishment as main plot (**T_1**-Recommended transplanting at 20X15 cm, **T_2**-Random transplanting, **T_3**-Random broadcasting of 30 days old seedling (*Awatni*), **T_4-**Random broadcasting of 20 days old seedling (*Awatni*)), three nitrogen levels in sub plot (**F_1**-60 kg N ha^{-1}, **F_2**-80 kg N ha^{-1}, **F3-**100 kg N ha^{-1}) and four times of nitrogen application as sub-sub plot (**S_0**-Basal- (half dose through suphala (15:15:15))**,** **S_1**-2 Split- TP, 30 DAT, **S_2**-3 Split- TP, 30 DAT, 60 DAT, **S_3**-4 Split- TP, 20 DAT, 40 DAT, 60 DAT). Plant geometry was maintained with 20X15 cm^2 spacing. The all biometrical and phenological observations were recorded at different stages of crop growth. Quantity of nitrogen applied is for Basal-100 %, 2 split – 50%, 50%, 3 split -33.3%, 33.3% & 33.3%, 4 split- 25%, 25%, 25% & 25%.

The nursery was manured with farmyard manure and it was mixed thoroughly in soil at the time of seedbed preparation. Fertilizers *viz.*, urea and single super phosphate at the time of sowing. Later it was top dressed with urea 0.5 kg per 100 m^2 at 15 DAS. Spraying of COC was carried out before transplanting. For sowing of finger millet crop different methods were adopted in this region that are as follows. 1. Recommended Transplanting of crop at 20X15 cm (Transplanting of *nagli* was done, when seedlings were 30 days old. The field was prepared for transplanting by ploughing. Transplanting of the seedlings was done across the slope. Whereas, in transplanting two seedlings $hill^{-1}$ was transplanted at 20x15 cm^2 spacing. Transplanting was done by using *thomba*). 2. Random transplanting (Transplanting of seedlings was carried out like recommended transplanting method except keeping the line spacing and mostly adopted by farmers in this region. Farmers generally use half dose of fertilizer as a basal dose in the form of mixed fertilizers and other management practices are used as par the other methods of crop establishment). 3. Random broadcasting of 20 and 30 days old seedlings (*Awatni*) (In *awatni* methods, 20 and 30 days old, healthy and vigorous seedlings were uprooted and thereafter, seedlings were transplanted by broadcasting randomly in *awatni* method as per the treatments in the experimental field. Here, 20 days old seedlings were taken for transplanting on the basis of SRI methods used in rice. To get the benefits of early age seedlings to reduce the life span of seedlings in nursery as well as early aged seedlings establish easily than old once as well as mature early).

Fertilizer application was done as per the recommended dose of the crop. The RDF for finger millet is 80:40:00 kg NPK ha^{-1}, as per the treatments. Nitrogen was applied in the form of urea (46% N as per treatments while phosphorus through single super phosphate (16% P_2O_5). In random transplanting (Farmers practice), basal dose of fertilizer was used in half quantity in the form of mixed fertilizers.

Different biometrical and phonological observations were recorded at different growth stages of crop as follows.

RESULTS AND DISCUSSION

Effect of Establishment Techniques

Recommended transplanting was significantly superior over rest of the treatments which recorded significantly higher grain yields ha^{-1} followed by random transplanting, random broadcasting of 30 days old seedlings and random broadcasting of 20 days old seedlings in the descending order. Increase in the yield due to recommended transplanting technique was to the tune of 12.65%, 26.85% and 30.50% over random transplanting, random broadcasting of 30 days old seedlings and random broadcasting of 20 days old seedlings, respectively. Similar trend was also observed in case of straw yield (Table 1). This may be ascribed to the beneficial effect of recommended transplanting technique on yield attributes which might have contributed to increased growth and development parameters, which finally enhanced the grain yield of finger millet. These results corroborated the findings of Newase *et al.* (1995), Singh *et al.* (2006) and Jagtap (2011).

In respect of economics, it was observed that recommended transplanting techniques of finger millet cultivation recorded the highest gross returns (Rs.56,583.50 ha^{-1}, Rs.62,352.67 ha^{-1} and Rs.59,468.08 ha^{-1}), net returns (Rs.8,069.25 ha^{-1}, Rs.10,627.92 ha^{-1} and Rs.9,348.58 ha^{-1}) and benefit cost ratio (1.16, 1.20 and 1.18) followed by random transplanting, random broadcasting of 30 days old seedlings and random broadcasting of 20 days old seedlings techniques during the year 2011, 2012 and in the pooled mean, respectively. Among all the establishment techniques recommended transplanting was found to be economically most profitable as its mean B:C ratio was 1.18. The increased gross returns, net returns and benefit cost ratio due to recommended transplanting techniques were mainly due to increased grain and straw yield under recommended transplanting over rest of the establishment techniques. This was in line with the observations reported by Santhi *et al.* (1998), Sanjay *et al.* (2006), Awan *et al.* (2007) and Jagtap (2011).

Effect of nitrogen levels

Data presented in Table 1 indicated that, grain and straw yields of finger millet were significantly influenced by the 100 kg nitrogen application. In case of grain and straw yield, data furnished in Table 1 stipulated that, the response to the different levels of nitrogen was influenced significantly in respect of grain and straw yield ha^{-1}. The grain and straw yield increased significantly with subsequent increase in the nitrogen levels and therefore, it was significantly higher and maximum under 100 kg N ha^{-1} (F_3) followed by 80 kg N ha^{-1} (F_2), which was also found to be significant over 60 kg N ha^{-1} (F_1) during both the years and in the pooled mean. Treatment 100 kg N ha^{-1} recorded significantly higher grain and straw yield compared with 80 kg N ha^{-1}. The increase in grain yield due to treatment 100 kg N ha^{-1} (F_3) over 80 kg N ha^{-1} (F_2) and 60 kg N ha^{-1} (F_1) was 17.43% and 28.43%, respectively. And the increase in mean straw yield due to the nitrogen levels 100 kg N ha^{-1} (F_3) over the 80 kg N ha^{-1} (F_2) and 60 kg N ha^{-1} (F_1) was in the range of 20.02% and 33.31%, respectively.

100 kg N application increased the N uptake, leading to greater dry matter production and its translocation towards sink. Similar results have been reported by Panda and Das (1997). Absorption of more nutrients in the treatment 100 kg N ha^{-1} resulted into vigorous growth through more number of leaves at all the growth stages of crop which ultimately resulted in to higher photosynthetic activity and the synthesis of higher amount of food by crop. Every increase in the nitrogen level significantly increased grain and straw yield of finger millet. These results corroborated the findings of Singh (1997), Camara *et al.* (2003) and Anil Kumar *et al.* (2003). This increase in grain yield with increase in N dose was due to more number of productive tillers. These findings confirm the results of Sharma and Rajat (1975), Om *et al.* (1997) and Parshuramkar *et al.* (2012).

Application of 100 kg N ha^{-1} levels of nitrogen gave maximum gross returns (Rs.54,151.04 ha^{-1}, Rs.61,651.90 ha^{-1} and Rs.57,901.47 ha^{-1}), net returns (Rs.6,343.17 ha^{-1}, Rs.10,199.90 ha^{-1} and Rs.8,271.53 ha^{-1}) and B:C ratio (1.12, 1.19 and 1.16) over rest of nitrogen levels during year 2011, 2012 and in the pooled mean, respectively. These increased economic parameters were due to significant improvement in grain and straw yield of *nagli*. This was in agreement with the observations of has also reported by Tondon (1971), Ghodake (2008) and Mane *et al.* (2012).

Effect of time of nitrogen application

It was observed that all the split application of nitrogen recorded significantly higher grain and straw yield ha^{-1} over basal dose of nitrogen application (S_o). Three splits of nitrogen application (S_2) recorded significantly higher grain and straw yield than rest of the treatments under study. Treatment four splits (S_3) recorded significantly higher grain and straw yield of finger millet over two splits of nitrogen application. The significantly lowest grain and straw yield was recorded in basal dose (S_o) of nitrogen application during both the years and in the pooled mean. Increase in grain yield due to split application of nitrogen in case of S_2 over the treatment S_3, S_1 and S_o was in the range of 7.18%, 17.14% and 25.32%, respectively. The increase in straw yield was due to the time of nitrogen application at three splits of nitrogen application over four splits, two splits and basal dose of nitrogen was to the tune of 9.58%, 18.24% and 26.56%, respectively. Application of nitrogen at different stages of crop growth also significantly influenced the yield attributes and helped for reduction in loss of nitrogen but also increased the nitrogen absorption, consequently better utilization of applied nitrogen leads to higher yield attributes and finally resulted in higher grain and straw yield. Higher leaching and overflow losses resulted in significantly lower yield with four splits (S_3) than with three split application of nitrogen (S_2) and also it was adjusted to tillering and earhead initiation stages of crop growth. To exploit the high yield potential of the crop, quantity of nitrogenous fertilizer with split application directly involves in enhancing crop productivity as earlier reported by Satyanarayanan *et al*., (2004) and Sahar *et al.* (2012).

Table 1
Effect of establishment techniques, levels and time of nitrogen application on mean yield of grain and straw (q ha^{-1}) of finger millet

Treatments	*Grain yield (q ha^{-1})*			*Straw yield (q ha^{-1})*		
	2011	*2012*	*Pooled*	*2011*	*2012*	*Pooled*
A. Establishment techniques						
T_1: Recommended Transplanting	25.11	27.55	26.33	31.80	36.31	34.05
T_2: Random Transplanting	21.94	24.05	23.00	27.25	30.70	28.98
T_3: Random Broadcasting of 30 Days Old Seedlings	18.47	20.04	19.26	22.47	24.26	23.36
T_4: Random Broadcasting of 20 Days Old Seedlings	16.45	20.15	18.30	19.78	25.22	22.50
S.E (m)±	0.10	0.11	0.07	0.25	0.31	0.24
C.D. at 5 %	0.36	0.39	0.25	0.87	1.06	0.84
B. Nitrogen levels						
F_1: 60 kg ha^{-1}	17.54	19.17	18.35	20.50	23.66	22.08
F_2: 80 kg ha^{-1}	19.97	22.37	21.17	24.43	28.52	26.48
F_3: 100 kg ha^{-1}	23.97	27.31	25.64	31.04	35.18	33.11
S.E (m)±	0.16	0.15	0.10	0.19	0.12	0.09
C.D. at 5 %	0.48	0.45	0.30	0.57	0.36	0.28
C. Time of nitrogen application						
S_0: Basal dose (half dose through suphala (15:15:15))	17.49	19.56	18.52	21.40	24.88	23.14
S_1: 2 Split- TP, 30 DAT	19.30	21.80	20.55	24.02	27.49	25.76
S_2 : 3 Split- TP, 30, 60 DAT	23.49	26.10	24.80	29.28	33.74	31.51
S_3 : 4 Split-TP, 20, 40, 60 DAT	21.70	24.34	23.02	26.60	30.38	28.49
S.E(m) ±	0.18	0.15	0.11	0.20	0.20	0.12
C.D. at 5 %	0.51	0.43	0.32	0.56	0.58	0.35
Interaction effect						
		AXB	AXB	AXB	AXB	AXB
S.E (m)±		0.30	0.20	0.38	0.24	0.19
C.D. at 5 %		0.90	0.59	1.15	0.73	0.56
General Mean	20.49	22.95	21.72	25.32	29.12	27.22

Table 2
Economics of various treatments

Treatments	*Gross returns (Rs. ha^{-1})*			*Cost of cultivation (Rs. ha^{-1})*			*Net returns (Rs. ha^{-1})*			*B: C ratio*		
	2011	*2012*	*Mean*	*2011*	*2012*	*Mean*	*2011*	*2012*	*Mean*	*2011*	*2012*	*mean*
A. Establishment Techniques												
T_1: Recommended Transplanting	56583.50	62352.67	59468.08	48514.25	51724.75	50119.50	8069.25	10627.92	9348.58	1.16	1.20	1.18
T_2: Random Transplanting	49329.17	54245.17	51787.17	46786.42	50013.75	48400.08	2542.75	4231.42	3387.08	1.05	1.08	1.06
T_3: Random Broadcasting of 30 Days Old Seedlings	41440.59	44957.31	43198.95	42546.33	45619.67	44083.00	-1105.74	-662.36	-884.05	0.97	0.98	0.97
T_4: Random Broadcasting of 20 Days Old Seedlings	36848.89	45336.39	41092.64	42491.33	46260.33	44376.08	-5642.94	-923.94	-3283.44	0.86	0.97	0.91
S.E (m)±	212.30	240.83	173.01	—	—	—	212.30	240.83	173.01	—	—	—
C.D. at 5 %	734.65	833.38	598.70	—	—	—	734.65	833.38	598.70	—	—	—
B. Nitrogen Levels												
F_1: 60 kg ha^{-1}	39179.00	43073.25	41126.13	42562.94	45589.06	44076.00	-3383.94	-2515.81	-2949.88	0.91	0.93	0.92
F_2: 80 kg ha^{-1}	44821.57	50443.50	47632.54	44883.31	48172.81	46528.06	-61.74	2270.69	1104.47	0.99	1.04	1.01
F_3: 100 kg ha^{-1}	54151.04	61651.90	57901.47	47807.88	51452.08	49629.94	6343.17	10199.90	8271.53	1.12	1.19	1.16
S.E(m) ±	326.63	310.85	198.61	—	—	—	326.63	310.85	198.61	—	—	—
C.D. at 5 %	979.24	931.94	595.44	—	—	—	979.24	931.94	595.44	—	—	—
C. Time of Nitrogen Application												
S_0: Basal ((half dose through sufala (15:15:15))	39254.26	44089.19	41671.72	42624.67	45824.17	44224.42	-3370.41	-1734.98	-2552.69	0.91	0.95	0.93
S_1 : 2 Split-TP, 30 DAT	43397.42	49097.97	46247.69	44343.25	47672.00	46007.63	-945.83	1425.97	240.07	0.97	1.02	0.99
S_2 : 3 Split-TP, 30, 60 DAT	52840.73	58945.86	55893.29	46550.92	49945.58	48248.25	6289.81	9000.27	7645.04	1.13	1.17	1.15
S_3: 4 Split-TP,20,40,60 DAT	48709.74	54758.52	51734.13	46820.00	50176.75	48498.38	1889.74	4581.77	3235.76	1.03	1.08	1.06
S.E(m) ±	368.52	304.46	232.07	—-	—	—	368.32	304.46	232.07	—	—	—
C.D. at 5 %	1038.92	858.34	654.26	—	—	—	1038.92	858.34	654.26	—	—	—
Interaction effect												
	AB	AB	AB					AB	AB			
S.E(m) ±	653.26	621.71	397.22	—	—-	—	—	621.71	397.22	—	—	—
C.D. at 5 %	1958.47	1863.88	1190.88	—	—	—	—	1863.88	1190.88	—	—	—
General Mean	46050.54	51722.08	48686.71	45084.71	48404.63	46744.67	965.83	3318.26	2142.04	1.01	1.06	1.03

Table 3

Economics of interaction effect of different treatments

Sr. No.	T Treatments	Gross returns (Rs. ha^{-1}) 2011	Gross returns 2012	Gross returns Pooled	Cost of cultivation (Rs. ha^{-1}) 2011	Cost of cultivation 2012	Cost of cultivation Pooled	Net returns (Rs. ha^{-1}) 2011	Net returns 2012	Net returns Pooled	B: C ratio 2011	B: C ratio 2012	B: C ratio Pooled
1	$T_1F_1S_0$	41857.33	47499.33	44678.33	43406.00	46582.00	44994.00	-1548.67	917.33	-315.67	0.96	1.02	0.99
2	$T_1F_1S_1$	45456.67	52634.67	49045.67	45130.00	48562.00	46846.00	326.67	4072.67	2199.67	1.01	1.08	1.05
3	$T_1F_1S_2$	54513.33	63010.67	58762.00	47149.00	50783.00	48966.00	7364.33	12227.67	9796.00	1.16	1.24	1.20
4	$T_1F_1S_3$	51798.00	57326.67	54562.33	47543.00	50870.00	49206.50	4255.00	6456.67	5355.83	1.09	1.13	1.11
5	$T_1F_2S_0$	47540.00	53408.67	50474.33	45670.00	48884.00	47277.00	1870.00	4524.67	3197.33	1.04	1.09	1.07
6	$T_1F_2S_1$	52132.00	59652.67	55892.33	47595.00	51087.00	49341.00	4537.00	8565.67	6551.33	1.10	1.17	1.13
7	$T_1F_2S_2$	62329.33	68858.00	65593.67	49804.00	53129.00	51466.50	12525.33	15729.00	14127.17	1.25	1.30	1.27
8	$T_1F_2S_3$	57706.67	64364.00	61035.33	49892.00	53227.00	51559.50	7814.67	11137.00	9475.83	1.16	1.21	1.18
9	$T_1F_3S_0$	58816.67	62036.00	60426.33	48865.00	51638.00	50251.50	9951.67	10398.00	10174.83	1.20	1.20	1.20
10	$T_1F_3S_1$	64226.67	67347.33	65787.00	50964.00	53721.00	52342.50	13262.67	13626.33	13444.50	1.26	1.25	1.26
11	$T_1F_3S_2$	73610.67	78283.33	75947.00	53035.00	56051.00	54543.00	20575.67	22232.33	21404.00	1.39	1.40	1.39
12	$T_1F_3S_3$	69014.67	71910.67	70462.67	53118.00	56163.00	54640.50	15896.67	15747.67	15822.17	1.30	1.28	1.29
13	$T_2F_1S_0$	35848.00	38380.67	37114.33	41555.00	44383.00	42969.00	-5707.00	-6002.33	-5854.67	0.86	0.86	0.86
14	$T_2F_1S_1$	39608.67	44620.00	42114.33	43639.00	46883.00	45261.00	-4030.33	-2263.00	-3146.67	0.91	0.95	0.93
15	$T_2F_1S_2$	49990.00	55425.33	52707.67	45857.00	49190.00	47523.50	4133.00	6235.33	5184.17	1.09	1.13	1.11
16	$T_2F_1S_3$	45956.67	49664.67	47810.67	46058.00	49427.00	47742.50	-101.33	237.67	68.17	1.00	1.00	1.00
17	$T_2F_2S_0$	42350.67	45083.33	43717.00	43957.00	46818.00	45387.50	-1606.33	-1734.67	-1670.50	0.96	0.96	0.96
18	$T_2F_2S_1$	46912.67	49614.00	48263.33	46320.00	49176.00	47748.00	592.67	438.00	515.33	1.01	1.01	1.01
19	$T_2F_2S_2$	54014.00	59056.67	56535.33	48014.00	51260.00	49637.00	6000.00	7796.67	6898.33	1.12	1.15	1.14
20	$T_2F_2S_3$	50654.00	53764.00	52209.00	48300.00	51538.00	49919.00	2354.00	2226.00	2290.00	1.05	1.04	1.05
21	$T_2F_3S_0$	49561.73	55362.00	52461.87	46476.00	49848.00	48162.00	3085.73	5514.00	4299.87	1.07	1.11	1.09
22	$T_2F_3S_1$	52985.07	59075.33	56030.20	48796.00	52219.00	50507.50	4189.07	6856.33	5522.70	1.09	1.13	1.11
23	$T_2F_3S_2$	63799.60	70130.67	66965.13	51100.00	54569.00	52834.50	12699.60	15561.67	14130.63	1.25	1.29	1.27
24	$T_2F_3S_3$	60268.93	64282.67	62275.80	51365.00	54854.00	53109.50	8903.93	9428.67	9166.30	1.17	1.17	1.17
25	$T_3F_1S_0$	27502.00	28069.33	27785.67	37942.00	40459.00	39200.50	-10440.00	-12389.67	-11414.83	0.72	0.69	0.71

Contd. table 3

Sr. No.	T Treatments	Gross returns (Rs. ha^{-1})			Cost of cultivation (Rs. ha^{-1})			Net returns (Rs. ha^{-1})			B: C ratio		
		2011	2012	Pooled	2011	2012	Pooled	2011	2012	Pooled	2011	2012	Pooled
26	$T_3F_1S_1$	32497.33	33726.67	33112.00	39073.00	41687.00	40380.00	-6575.67	-7960.33	-7268.00	0.83	0.81	0.82
27	$T_3F_1S_2$	41070.67	41930.00	41500.33	41347.00	43781.00	42564.00	-276.33	-1851.00	-1063.67	0.99	0.96	0.98
28	$T_3F_1S_3$	37132.00	37566.67	37349.33	41703.00	44231.00	42967.00	-4571.00	-6664.33	-5617.67	0.89	0.85	0.87
29	$T_3F_2S_0$	34379.33	36362.67	35371.00	40512.00	43334.00	41923.00	-6132.67	-6971.33	-6552.00	0.85	0.84	0.84
30	$T_3F_2S_1$	37242.67	41238.00	39240.33	41215.00	44288.00	42751.50	-3972.33	-3050.00	-3511.17	0.90	0.93	0.92
31	$T_3F_2S_2$	45936.47	51926.00	48931.23	43513.00	46916.00	45214.50	2423.47	5010.00	3716.73	1.06	1.11	1.08
32	$T_3F_2S_3$	42282.67	46068.67	44175.67	43924.00	47357.00	45640.50	-1641.33	-1288.33	-1464.83	0.96	0.97	0.97
33	$T_3F_3S_0$	42921.33	48381.33	45651.33	43476.00	47016.00	45246.00	-554.67	1365.33	405.33	0.99	1.03	1.01
34	$T_3F_3S_1$	46738.00	52959.33	49848.67	44150.00	47727.00	45938.50	2588.00	5232.33	3910.17	1.06	1.11	1.08
35	$T_3F_3S_2$	56718.00	62091.33	59404.67	46661.00	50095.00	48378.00	10057.00	11996.33	11026.67	1.22	1.24	1.23
36	$T_3F_3S_3$	52866.67	57246.67	55056.67	47040.00	50545.00	48792.50	5826.67	6701.67	6264.17	1.12	1.13	1.13
37	$T_4F_1S_0$	24136.00	27294.00	25715.00	37569.00	40501.00	39035.00	-13433.00	-13207.00	-13320.00	0.64	0.67	0.66
38	$T_4F_1S_1$	28424.00	32528.00	30476.00	39409.00	42499.00	40954.00	-10985.00	-9971.00	-10478.00	0.72	0.77	0.74
39	$T_4F_1S_2$	38070.67	41851.33	39961.00	41697.00	44730.00	43213.50	-3626.33	-2878.67	-3252.50	0.91	0.94	0.92
40	$T_4F_1S_3$	33002.67	36139.33	34571.00	41930.00	44857.00	43393.50	-8927.33	-8717.67	-8822.50	0.79	0.81	0.80
41	$T_4F_2S_0$	28708.67	36611.33	32660.00	39648.00	43373.00	41510.50	-10939.33	-6761.67	-8850.50	0.72	0.84	0.78
42	$T_4F_2S_1$	33228.67	40688.67	36958.67	41563.00	45214.00	43388.50	-8334.33	-4525.33	-6429.83	0.80	0.90	0.85
43	$T_4F_2S_2$	43701.33	50517.33	47109.33	43988.00	47530.00	45759.00	-286.67	2987.33	1350.33	0.99	1.06	1.03
44	$T_4F_2S_3$	38026.00	44886.00	41456.00	44218.00	47634.00	45926.00	-6192.00	-2748.00	-4470.00	0.86	0.94	0.90
45	$T_4F_3S_0$	37429.33	50791.60	44110.47	42420.00	47054.00	44737.00	-4990.67	3737.60	-626.53	0.88	1.08	0.98
46	$T_4F_3S_1$	41316.67	55300.93	48308.80	44265.00	49001.00	46633.00	-2948.33	6299.93	1675.80	0.93	1.13	1.03
47	$T_4F_3S_2$	50334.67	65112.93	57723.80	46446.00	51313.00	48879.50	3888.67	13799.93	8844.30	1.08	1.27	1.18
48	$T_4F_3S_3$	45808.00	59868.27	52838.13	46749.00	51418.00	49083.50	-941.00	8450.27	3754.63	0.98	1.16	1.07

Application of nitrogen into three splits gave maximum gross returns (Rs.52,840.73 ha^{-1}, Rs.58,945.86ha^{-1} and Rs.55,893.29 ha^{-1}), net returns (Rs.6,289.81 ha^{-1}, Rs.9,000.27ha^{-1} and Rs.7645.04 ha^{-1}) and B;C ratio (1.13, 1.17 and 1.15) over rest of the treatments during the year 2011, 2012 and in the pooled mean, respectively. These increased economic parameters were due to significant improvement in grain and straw yield of *nagli*. Similar results were also reported by Ved Prakash (1989) and Ananda (2004).

Interaction effect of establishment techniques, nitrogen levels and time of nitrogen application

Grain and straw yield were not influenced significantly due to interaction effect of establishment techniques, nitrogen levels and time of nitrogen application in finger millet during both the years of study also similar line with Avasthe (2009).

Economics of treatment combination

Acceptance of any new techniques of establishment, levels and time of nitrogen application in crop by the farmer depends largely on comparative economics of the treatments. The time of nitrogen application was effective in controlling losses carried out due to leaching, denitrification and volatilization in case of nitrogenous fertilizers mostly. Nitrogenous fertilizers are very costly now a days and that was not sustained by the marginal farmer of *konkan* region.

The data presented in Table 3 indicated that, maximum net return was obtained due to recommended transplanted finger millet crop combined with 100 kg nitrogen per hectare into 3 splits of nitrogen application (at transplanting, 30 and 60 DAT) (Rs.20,575.67 ha^{-1}, Rs.22,232.33 ha^{-1} and Rs.21,404.00 ha^{-1}) and benefit cost ratio of 1.39, 1.40 and 1.39 followed by the recommended transplanted finger millet crop combined with 100 kg nitrogen per hectare into four splits of nitrogen application (at transplanting, 20, 40 and 60 DAT) with manual weeding (at 30 and 60 DAT) (Rs.15,896.67 ha^{-1}, Rs.15747.67 ha^{-1} and Rs.15,822.17 ha^{-1}) and benefit cost ratio of 1.30, 1.28 and 1.29 than rest of the treatment combinations.

CONCLUSION

The results of investigation clearly showed that finger millet crop established by recommended transplanting and 100 kg nitrogen per hectare with 3 splits of nitrogen application (at TP, 30 and 60 DAT) gave higher returns, net returns and B:C ratio.

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