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SEEDLING THROWING METHOD-A NEW CONCEPT FOR LOWLAND RICE PRODUCTION TECHNOLOGY

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ABSTRACT

Feild experiments were conducted in *Kharif* and *Rabi* 1995-96 on a clay loam soil (Typic Haplustalf)at Tamil Nadu Agricultural University,Coimbatore, to test the effect of seedling age(20,25,30,35 and 40 day),nitrogen (N) dose (120,150,180,and 187.5 kg ha^{-1}) and split application (3,4 and 5) on seedling throwing method of rice planting. The grain yield of rice varied with different seedlings ages. In *Rabi*, the performance of 20 day old seedlings was not encouraging as there was 15.9 per cent yield reduction compared to older seedlings of 30 to 40 day. The two levels of (150 and 187.5kg/ha) tried did not markedly influence the grain yield in *Rabi* season. However,a substantial influence in grain yield with applied N was noticed during the season. In both the seasons skipping the basal application of N and increasing the split application increased the grain yield. Application of N in four splits increased the yield by 5.3 per cent during *Rabi* compared to three splits application. In *Kharif* season five splits increased the yield to the tune of 3.6 per cent (243kg/ha^{-1}) as against four splits.

KEY BOARDS: Seedling age,N Levels,N split application

Rice being a semi-aquatic plant,transplanting method of establishment is the most favourable one. It is believed to give more staple grain yield than direct seedling methods (Biswas et al., 1991). Line Planting is seldom practised by the farmers of Tamil Nadu, obvviously due to socio-economic considerations. The need for a satisfactory alternative to the transplanting of rice, in the context of the scarcity and increasing cost of labour and the desire to reduce the drudgery of the women, has been very much felt and attempts were made in this direction. In South East Asian Countries,a method of rice crop establishment simply by throwing the rice seedlings into the puddled field has been developed to achieve better management and yield in rice cultivation (Matsushima,1979). In Kerala, Varughese et al.(1993) also studied the seedling throwing method of rice planting in the context of scarcity of human labour and higher cost and drudgery involved in transplanting.

Seedling age at transplanting plays a crucial role to achieve uniform crop stand in realising the potential yield. Though a linear decline in yield was obtained with older seedlings of transplanted crop, Matsushima (1979) recommended aged seedlings for seedling throwing method of rice planting. Crop yield is influenced,often decisively by the extent to which the plant requirement for N can be met. The nutilisation by rice in India reveals that the recovery of applied N ranged from 19.1

to39.8% (Meelu,1980). Split application of N is perhaps the simplest agronomic solution in improving the use efficiency of N,since the N demand is not same throughout the plant growth period (Manjappa et al.,1994), So far lot of research work has been done on the traditional transplanting method,but there is a paucity of information about seedling age,dose and split application of N for seedling throwing method. Hence,the effect of seedling age, N dose and split application on seedling throwing method was studied in this experiment.

MATERIALS AND METHODS

The experiments were conducted in the Wetland Farm of Tamil Nadu Agricultural University,Coimbatore during the *Rabi* season(October 1995 to Februar,1996) and the *Kharif* season (June to september 1996). The soil texture was clay loam classified as Typic Haplustalf, with pH of 8.0. The soil was low in available N (198.5 kg/ha^{-1}), medium in phosphorus (18.6kg/ha^{-1}) and high in potassium (557 kg ha^{-1}) contents.

The experiments were laid out in a factorial randomized block design with three replications.The 12 treatment combinations involved for seedling throwing method in *Rabi* season included three seedling ages (20,30 and 40 day old), two N doses (150 and 187.5 kg ha^{-1}) and two split applications (three and four). In the *Kharif* season, two seedling ages (25 and 35 day old), three N doses (120,150 and 180 kg ha^{-1}) and two split application (four and five) were studied. The new method of rice planting by seedling throwing under the above 12 treatment combinations were compared with line and random planted crops that were grown with the recommended package of production practices. The experimental plot size was 6 m x 4 m.

Rice varieties *viz.*,ADT 38 (medium duration) and ADT 36 (short duration) were utilised during *Rabi* and *Kharif* seasons respectively. The field was puddled and uniformly levelled. A uniform dose of P_2O_5 and K_2O (each of 50kg and 38kg ha^{-1} during rabi,Kharif seasons respectively) was applied in the form of super phosphate and muriate of potash. While,N as urea was applied as per treatments. Nitrogen was applied in three splits (50 percent basal,25 percent each at active tillering (AT) and panicle initiation (PI); four splits (25 per cent each at 10 day after seedling throwing (DAST),AT, PI and flowering (F) and five splits (10 DAST,AT,PL, F and 10 DAF) as per treatments. Full doses of P_2O_5 and $ZnSo_4$ (25 kg/ha) were applied at the last puddling and K_2O was applied in equal splits along with N.

Two or three seedlings were separated as in normal transplanting and were thrown at random in the respective plots by hand form a standing position without using force. In seedling throwing plots, 25 per cent more seedlings were used than the line planting method, which was calculated according to plant spacing adopted in the respective seasons. The growth parameters and yield components were recorded by adopting standard procedures. The experimental plot size was 6 m X 4 m and the grain yield was expressed in t ha^{-1} at 14 per cent moisture.

RESULTS AND DISCUSSION

Crop Growth

The age of seedlings had a marked influence on LAI and yield components of rice. In the *Rabi* season, 30 and 40 day old seedlings recorded higher LAI compared to that with 20 day old seedlings.

Similarly in *Kharif* season older seedlings (35 day old)recored markedly higher LAI (5.60) against younger seedlings of 25 day old (4.93). More number of tillers with aged seedlings (Esther shekinah,1996) might have contributed to 11.7 and 12.0 per cent increase in LAI compared to younger seedlings of 20 and 25 day in *Rabi* and *Kharif* seasons respectively. Irrespective of the season, increasing the number of split application of N invariably increased the LAI of crop.

Yield parameters

Use of 30 or 40 days old seedlings recorded substantially more number of panicles m^{-2} (486) and filled grains panicle^{-1} (90.4) compared to that 20 day old seedlings (439 and 83 respectively) in the *Rabi* season. Similarly in the *Kharif* season also older seedlings (35 day old) recorded more number of panicles m^{-2} (511) and filled grains panicle^{-1} (94.8) compared to that of 25 day old seedlings (456 and 82.8 respectively) (Table 1). Although these yield

Table 1. Effect of treatments on growth and yield components of rice established by seedling throwing method

Treatments		*Rabi* season 1995-'96				*Kharif* season '96			
Rabi season	*Kharif* season	LAI (flowering)	Panicle m^{-2}	Filled grains $panicle^{-1}$	Unfilled grain panicle (%)	LAI (flowering)	Panicle m^{-2}	Filled grains $panicle^{-1}$	Unfilled grain panicle (%)
Seedling age (day)									
20	-	5.08	439	83.0	22.1	-	-	-	-
30	25	5.78	487	91.5	14.1	4.93	456	82.8	20.2
40	35	5.72	486	90.3	13.9	5.60	511	94.8	17.8
	SEd	0.08	4.0	1.6	0.62	0.08	4.1	0.95	0.54
	CD 5%	0.17	9.2	3.2	1.30	0.15	8.3	2.0	1.10
N dose (kg/ha^{-1})									
150	120	5.50	469	86.9	16.2	4.69	437	78.2	21.3
187.5	150	5.55	472	89.6	17.2	5.23	482	88.6	17.7
-	180	-	-	-	-	5.89	531	99.5	18.0
	SEd	0.08	4.0	1.5	0.51	0.09	4.2	1.2	0.66
	CD 5%	NS	NS	NS	1.10	0.19	9.1	2.4	1.40
N splits									
3	4	5.35	459	85.9	17.7	5.10	471	85.6	20.2
4	5	5.70	483	90.5	15.7	5.40	496	92.0	178
	SEd	0.06	3.2	1.3	0.51	0.08	4.1	0.95	0.54
	CD 5%	0.14	7.1	2.6	1.10	0.15	8.3	2.0	1.10

components were not influenced by N levels in the *Rabi* season, substantial increase in the tiller production and filled grain $panicle^{-1}$ was observed with every increment of N from 120 to 180 kg ha^{-1}, the maximum being with 180 Kg N/ha in the *Kharif* season. Regarding split application of N, four splits recorded higher number of panicles m^{-2} (459). In dry season five splits recorded higher number of panicles m^{-2} (496) compared to four splits (471).

Yield

The performance of 20 day old seedlings was not encouraging as there was 15.9 per cent yield reduction compared to older seedlings of 30 to 40 day in the *Rabi* season. In the *Kharif* season also older seedlings performed better than young seedlings. The increased yield with the use of older seedlings might be due to cumulative effect of increased growth and yield attributes. Each Shekinath (1996) also opined that the broadcasting of older seedlings (35 day) resulted in higher grain yield (13.7% and 7.5% during the *Rabi* and *Kharif* seasons respectively). Padalia (1981) also stated that the restricted nutrient uptake with 20 day old seedlings might have led to higher sterility per cent and low yield (Table 2).

The two levels of N tried did not markedly influence the grain yield in rabi season. However during *Kharif*, an increment of 30 kg N ha^{-1} from recommended does (120 kg N/ha) increased the yield by 7%. Application of N in four splits in the *Rabi* season and five splits in the *Kharif* season increased the grain yield by 5.3% and 3.6% respectively compared to that of three and four splits in the respective seasons (Table 2). This might have increased the nutrient availability and uptake by the crop resulting in more number of filled grains and yield. Sivasamy (1994) also reported that the application of N in more number of splits ensured a steady supply of N over a longer period and hence resulted in higher amount of biological as well as economical yields.

Table 2. Effect of treatments on grain yield and economic indicies of wet season rice established by seedling throwing method

Treatments		*Rabi* season 1995-'96			*Kharif* season '96		
Rabi season	*Kharif* season	Grain yield (t ha^{-1})	Net income (Rs. ha^{-1})	B:C ratio	Grain yield (t ha^{-1})	Net income (Rs. ha^{-1})	B:C ratio
Seedling age (day)							
20	-	4.98	16063	2.55	-	-	3.11
30	25	5.95	20873	3.00	6.10	21272	3.28
40	35	5.90	20624	3.00	6.62	24157	-
	SEd	0.12	-	-	0.04		
	CD 5%	0.25	-	-	0.08		
N dose (kg/ha^{-1})							
150	120	5.55	18966	2.85	5.88	20531	2.99
187.5	150	5.67	19328	2.85	6.33	22676	3.22
-	180	-	-	-	6.82	24937	3.29
	SEd	0.10	-	-	0.05	-	-
	CD 5%	NS	-	-	0.10	-	-
N splits							
3	4	5.46	18419	2.77	6.22	22090	3.09
4	5	5.76	19954	2.93	6.47	23339	3.20
	SEd	0.10	-	-	0.04	-	0.48
	CD 5%	0.21	-	-	0.08	-	-

Economic

The crop established by throwing older seedlings recorded a higher B : C ratio of 3.00 during the *Rabi* season and 3.20 in the *Kharif* season, due to higher grain yield. Higher grain yield (6.82 t/ha) obtained with higher N application (180 kg N/ha) during *Kharif* season increased the B : C ratio with a maximum of 3.29. Although the B : C ratio was same (2.85) for both the N levels tried in *Rabi* season, the net income (Rs. 19328 ha^{-1}) was more higher N application rate. Increased number of N splits (4 in the *Rabi* seasons and 5 in the *Kharif* (season) subtantially increased the net income (Rs. 19954 and Rs. 23339 ha^{-1}) in *Rabi* and *Kharif* seasons respectively) and B : C ratio (2.93 and 3.20 respectively during *Rabi* and *Kharif* seasons) compared to three and four splits in the respective seasons (Table 2). Kandasamy *et al* (1996) also recorded the highest B:C ratio in seedling throwing method of rice planting.

The results of the two seasons study indicate that the throwing of rice seedlings under lowland condition is not only simple, but also practically feasible and less labour intensive. To sustain the yield level with seedling throwing method, use of 30 to 40 day old seedlings are found to be optimum. To maximise the N use, the basal application could be skipped and 150 kg N ha^{-1} could be top dressed either in 4 or 5 splits to maximise the yield and economics of rice established by seedling throwing method.

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BIOCONVERSION OF PAPER AND PULP MILL SOLID WASTES

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ABSTRACT

Begasse pith (BP) is solid waste discharged from bagasse based paper and and pulp industry. It contains high quality of cellulose and lignin. An attempt has been made to convert the bagasse pith into biomanure for land application using activated sludge (AS) and ETP sludge (ETPS) which are solid wastes obtained from the same factory rich in essential plant nutrient. The AS and ETPS were mixed with BP in different properties to maintain the optimum C : N ratio and nutritional requirement of microorganisms during composting. In order to enhance the composing process, an external source of inocula *viz., Pleurotus sajor-caju* (250kg), *Trichoderma viride* (0.4%) and a new bacterial culture, EM 4 (500ml) were added per 100 kg of substrate. The NPK were increased invariably in all treatments and the C/N ratio was reduced to a level suitable for land application within a period of 10 weeks. Mixing BP with AS and ETPS in 2:1:1 ratio produced a better quality compost than mixing BP with AS at 1:1 ratio.

KEYWORDS: Bioconversion, Paper mill solid wastes.

Growing literacy and high standard of living have increased the paper consumption, resulting in more pollution from paper industry. At present there are 75 paper and pulp industries in India with an installed capacity of 1.127 million tonnes per annum (Pandey, 1997) and many are going to be established in near future, capable of discharging large quantity of lignocellulosic waste materials. Being the second largest sugarcane growing country in the world, bagasse is a promising raw material for such industries in India. In the case of paper mill using bagasse as the raw material, bagasse pith which constitutes 30 per cent of bagasse is another source of pollution.

Other types of solid wastes are also generated during the mechanical and activated sludge treatment of pulp and paper mill waste waters. Activated Sludge (AS) which accounts for 10 - 50 per cent of total sludge (Rintala and Puhakka, 1994) is high in nutrients and a good source of microbial inoculum. Due to high content of organic matter in paper mill sludges, composting and land application are attractive alternatives for disposal (Bellamy et al., 1995) but high carbon content tends to lock up soil nitrogen when directly applied to the land (Dolar *et al.*, 1972). However a very few attempts have been made so far to utilize begasse pith for crop production. Because of high cellulose, lignin and C/N ratio, it cannot be applied directly to the land. Therefore an attempt was made to convert bagasse pith as a biomanure through acrobic composting using suitable microbial consortia.

MATERIALS AND METHODS

As experiment on acrobic composting of BP was taken up at Tamil Nadu Newsprint and Papers Limited (TNPL), Kagithapuram. The BP, AS and ETPS (Effluent Treatment Plant Sludge) collected from the factory were mixed in different properties