Madras Agric. J., 99 (10-12): 751-753, December 2012
https://doi.org/10.29321/MAJ.10.100187

Short Note

Crop Establishment Techniques and Nutrient Management Practices on Yield and Economics of Wet Seeded Lowland Rice

D. Kalaiyarasi*, P. Muthukrishnan and S. Ramasamy
Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore - 641 003

Field experiment was carried out at wetland of Tamil Nadu Agricultural University, Coimbatore during *Kharif* 2008. The experiment was laid out in a factorial randomized block design with three replications to evaluate the stand establishment techniques and nutrient management practices in wet seeded lowland rice. The treatments consisting of two establishment techniques (Direct planting system and drum seeding) and four levels of nutrient management practices (control, RDF, RDF+FYM and RDF+FYM+Biofertilizers). Direct planting system recorded higher yield components and grain yield compared to drum seeding method of crop establishment. Application of recommended dose of fertilizers (150:50:50 NPK kg ha^{-1}), FYM 12.5 t ha^{-1}and biofertilizers (Azosphosmet @ 2 kg ha^{-1}) + PPFM (pink pigmented facultative methylotroph) @ 5 L ha^{-1} enhanced the grain yield over no manure treatment under Direct Planting System when compared with drum seeding method. The net income and B:C were higher under DPS than drum seeding method due to higher grain yield.

Key words: Direct Planting System, Drum seeding, Rice, Nutrient management

Rice is the staple food of around three billion people across the globe and the demand continues to increase as population increases (Carriger and Vallee, 2007). There are three principal methods of rice crop establishment: dry seeding, wet seeding and transplanting. Although these methods differ among themselves, each is characterized by distinct features. Dry seeding consists of sowing dry seeds on dry (unsaturated) soils. Seeds can be broadcasted, drilled or dibbled. Wet seeding involves sowing pre germinated seeds in wet (saturated) puddled soils. Transplanting involves planting of rice seedlings grown in nurseries in puddled soils. Because the seeds are sown directly, the dry and wet-seeding methods are often jointly referred to as direct seeding. Direct seeding methods include manual broadcasting, spot seeding or dibbling and row seeding by drum seeder under aerobic or surface wet seeding and anaerobic broadcasting and anaerobic drum seeding.

Manual transplanting is the most common practice of rice cultivation in South and South East Asia. During peak agricultural season, timely planting becomes a constrain in the rice farming (Rajendra Prasad, 2004). Direct Planting System (DPS) is economically cost effective towards nursery and transplanting besides providing a desired plant density similar to system of Rice Intensification (SRI). This new technique has the merits of SRI. There is a significant saving of labour in crop establishment stages (sowing, transplanting, and weeding) by 60 per cent in DPS compared to conventional and SRI practices. Nutrient management is also one of the key components in rice production. Adequate supply of plant nutrients is crucial to ensure higher productivity (Uphoff, 2002). In this background a study was undertaken to develop appropriate nutrient management strategies involving organic, inorganic sources of nutrients and biofertilizers under direct planting system of rice production in combination with drum seeding technique.

[1]Corresponding author email: kalaiyarasi_agri@yahoo.co.in

Material and Methods

Field experiment was conducted in the wetland of TNAU, Coimbatore during *Kharif* 2008. The experiment was laid out in a Factorial Randomized Block Design with three replications. The soil fertility status was low in available nitrogen (196.3 kg ha^{-1}), medium in available phosphorus (20.4 kg ha^{-1}) and high in available potassium (450.2 kg ha^{-1}), respectively. Medium duration rice variety CO (R) 48 was used as a test variety in the present study. The treatment consists of Drum seeding and Direct Planting System (DPS) along with no manure, RDF (150:50:50 NPK kg ha^{-1}), FYM (12.5 t ha^{-1}) and biofertilizers (Azosphosmet @ 2 kg ha^{-1}) + PPFM @ 5 L ha^{-1}. The PPFM spray was given on 45, 75 and 100 DAS. The field was puddled and perfectly levelled and adequate drainage facility was provided. A seed rate of 30 kg ha^{-1} was adopted. The sprouted seeds were uniformly broadcasted in criss cross

direction. Careful water management practices were adopted in the first one week. Rotary weeder was used along the rows at 8 DAS to thin the plants in the rows of operation and across the rows at distance of 25 cm apart. Rotary weeding was repeated on 21 DAS. After second rotary weeding, the plants in the intersects were thinned out to one and the weeds removed manually.

Manually operated rice drum seeder developed by TNAU, Coimbatore was used. The seeder has two wheel at both the ends. It drops the seeds at 20 cm apart in continuous row. At a time eight rows of rice seeds were sown.

Recommended dose of fertilizer at 150:50:50 kg N, P_2O_5, K_2 O ha^{-1} was applied as per treatment schedule. The entire quantity of P was applied as basal as DAP. Nitrogen in the form of urea and potassium as muriate of potash were applied in four equal splits at basal, active tillering, panicle initiation and at flowering stages. The farm yard manure was applied @ 12.5 t ha^{-1} at last ploughing, incorporated and then leveled as per treatment. Azosphosmet @ 2 kg ha^{-1} was applied as basal dose (soil application) as per the treatment. Pink Pigmented Facultative Methylotroph (PPFM) was sprayed @ 1 ml/L of water at active tillering, panicle initiation and at 50 per cent ear head emergence stages.

Results and Discussion

Filled grain percentage

The filled grain percentage was influenced significantly by the interaction effect of method of stand establishment and nutrient management practices followed in this experiment (Table 1). Direct panting system improved the filled grains to 86.6 per cent while only 76.8 per cent grains were found filled under drum seeded technique. Application of manure improved the grain filling proportion in both the methods of stand establishments. Application of manure improved the grain filling proportion (number of filled grain) in both the methods of stand establishments. Therefore, it is clear that the establishment method, DPS underwent better root growth enhanced the better nutrient uptake, which ultimately resulted in more productive tillers, individual panicles weight and higher proportion of filled grains per panicle and thus, the grain yield. Similar result was reported by Janarthanan (2008).

Table 1. Stand establishment and nutrient management practices influence on filled grains panicle^{-1}, filled grain percentage, grain yield and harvest index in wet seeded lowland rice

Treatment	No. of filled grains panicle^{-1}	Filled grain (%)	Harvest index (%)	Grain yield (kg ha^{-1})
D_1N_1: DS -No manure	254.3	76.8	48.7	4896
D_1N_2: DS -RDF	265.6	88.5	46.4	5546
DN_1:DS_3 -RDF + FYM @12.5 t ha^{-1}	266.3	89.5	46.3	6033
DN_1:DS_4 -RDF + FYM @12.5 t ha^{-1} + Bio	272.3	91.4	48.4	6791
D_2N_1: DPS - No manure	265.6	86.6	44.8	6191
D_2N_2: DPS - RDF	276.0	92.3	42.1	6458
DN_2 : DPS - RDF +FYM @12.5 t ha^{-1}	279.6	92.6	43.4	7025
DN_2 : DPS - RDF +FYM @12.5 t ha^{-1}+ Bio	282.3	93.0	45.7	7983
SEd	17.5	0.7	0.8	81
CD	8.2	1.4	1.8	174
Methods of stand establishment				
D_1 :Drum seeding with modified drum seeder	264.6	86.5	47.4	5816
D_2 :Direct Planting System	275.9	91.1	44.0	6914
SEd	18.3	0.3	0.4	40
CD	9.2	0.7	0.9	87
Nutrient management				
N_1: No manure	260.0	81.7	46.8	5543
N_2:RDF	270.8	90.4	44.3	6002
N_3 : RDF + FYM @12.5 t ha^{-1}	273.0	91.0	44.8	6529
N_4 : RDF + FYM @12.5 t ha^{-1} + Bio	277.3	92.2	47.0	7387
SEd	17.22	0.5	0.6	57
CD	8.5	1.0	1.3	123
D x N SEd	17.3	0.7	0.8	81
D x N CD	8.2	1.4	NS	174

DS-Drum seeding, DPS-Direct Planting system ; RDF- Recommended dose of fertilizers (150:50:50 NPK kg ha^{-1}); Biofertilizers- Azophosmet @ 2 kg ha^{-1} (Soil application as a basal) +PPFM- Pink Pigmented Facultative Methylotroph

Grain yield

Direct planting system produced a grain yield of 6191 kg ha^{-1} without any manurial application, which was significantly higher than manured drum seeding

Table 2. Economics of stand establishment and nutrient management practices

Treatment	Specific cost	Total cost	Gross income	Net income	B:C
D_1N_1: DS-No manure	-	11995	33276	21281	2.7
D_1N_2:DS-RDF	3195	15190	50349	35159	3.3
D_1N_3: DS-RDF + FYM @12.5 t ha^{-1}	9685	21680	54780	33100	2.5
D_1N_4: DS-RDF + FYM @12.5 t ha^{-1} + Bio	10105	22100	61348	39248	2.7
D_2N_1: DPS - No manure	560	12555	43268	30713	3.4
D_2N_2: DPS - RDF	3775	15750	59330	43580	3.7
D_2N_3: DPS - RDF +FYM @12.5 t ha^{-1}	10245	22240	64295	42055	2.8
D_2N_4: DPS - RDF +FYM @12.5 t ha^{-1}+ Bio	10665	22660	72605	49945	3.2

DS-Drum seeding, DPS-Direct Planting system ; RDF- Recommended dose of fertilizers (150:50:50 NPK kg ha_{-1}) Biofertilizers- Azophosmet @ 2 kg ha_{-1} (Soil application as a basal) +PPFM – Pink Pigmented Facultative Methylotroph @ 1ml /lit of water at AT, PI, FF stages as a phyllosphere spray

technique (5546 kg ha^{-1}). The effect of farm yard manure was significant under both the methods of stand establishments in producing higher grain yield (Table 1). Biofertilizers application further enhanced the grain yield under both methods of stand establishment with more impact on direct planting system (7983 kg ha^{-1}) as compared to drum seeding (6791 kg ha^{-1}) and the yield increase was 11 per cent. Susheela (2007) reported higher grain yield (8.9 t ha^{-1}) under direct planting system of rice cultivation compared to conventional technique of transplanting (6.1 t ha^{-1}).

Application of manure had positive impact on grain yield. Recommended fertilizer application significantly recorded higher grain yield (6002 kg ha^{-1}). It further enhanced the grain yield when FYM 12.5 t ha^{-1} was combined (6529 kg ha^{-1}). A combined of application recommended fertilizer + FYM + biofertilizers improved grain filling percentage further enhanced the grain yield (7387 kg ha^{-1}) over to other treatments. Ramasamy *et al.* (1997) opined that better root cytokinins maintained by any method could improve the translocation of stored reserves from stem and leaves to sink more efficiently in order to improve the number of filled grains per panicle and grain yield. Biofertilizers is needed to maximize the productivity of rice along with recommended dose of fertilizers.

Harvest index

The harvest index was the highest under no manured situation of drum seeding. Application of recommended fertilizer pulled down the harvest index compared to no-manure. The negative impact was either reduced or nullified only when farm yard manure and biofertilizers were added to the fertilizer scheduled. Drum seeding had better harvest index than direct planting system (Table 1).

Economics

The net income was higher with recommended fertilizer + FYM + biofertilizers (Rs. 49,945/.) under direct planting system compared to other treatment combinations and nutrient management practices (Table 2). This was followed by the treatment combination of direct planting system with recommended fertilizer (Rs.43,580/). But the B:C ratio was higher (3.7) with recommended fertilizer application in direct planting system, which was followed by no manure application (3.4) under direct planting system and scheduled fertilizer under drum seeding method of establishment.

Conclusion

From the study, it is inferred that for higher yields and economic returns DPS holds promise over drum seeding of crop establishment with application of RDF (150:50:50 NPK kg ha^{-1}) + FYM (12.5 t ha^{-1}) + biofertilizers (Azosphosmet @ 2 kg ha^{-1}) with three spray of PPFM @ 5 lit ha^{-1}on 45, 75 and 100 DAS.

References

Carriger, F. and Valllee, D. 2007. More crop per drop. *Rice Today,* **6**: 10-13.

Janarthanan, P. 2008. Impact of number of seedlings and spacing in Direct Planting System and modified SRI method in rice cultivation. M.Sc.(Ag.) Thesis, Tamil Nadu Agricultural University, Coimbatore.

Ramasamy, S., Ten Berge, H.M.F. and Purushothaman, S. 1997. Yield formation in rice response to drainage and nitrogen application. *Field Crop Research*. **51**: p. 65-82.

Rajendra Prasad. 2004. Recent advances in rice agronomy. *Indian Farming,* p: 7-10.

Susheela, C. 2007. Evolving energy saving establishment technique for puddled lowland rice. Ph.D. Thesis, Tamil Nadu Agricultural University, Coimbatore, India.

Uphoff, N. 2002. Systems of rice intensification (SRI) for enhancing the productivity of land, labour and water. *J. Agric. Res. Manage.,* **1**: 43-49.

Received: April 20, 2012; Accepted: June 27, 2012