https://doi.org/10.17221/79/2016-RAE

Effect of growing media on mat type seedling raised for mechanical rice transplanting

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Abstract

Hossen M.A., Hossain M.M., Hawue M.E., Bell R.W. (2018): Effect of growing media on mat type seedling raised for mechanical rice transplanting. Res. Agr. Eng., 64: 157–167.

Mechanical transplanted seedling must meet the requirements of standard seedling block with uniform distribution of seedlings and inter-twisting roots for rolling. This study was conducted to identify the effect of growing media on mat type seedling raised for mechanical transplanting at Bangladesh Rice Research Institute (BRRI), Gazipur during the period of 2012–2014 covering two dry and cold seasons (Boro) and one wet season (Aman). Seedling were raised on plastic tray using sandy loam and clay loam soil mixed with decomposed cow-dung, mustard cake, rice straw organic fertilizer, rice bran, poultry litter and vermicompost at the rate of 0.0, 10, 20, 30 and 40%. Rolling quality of the seedling mat decreased and seedling height increased with the increased of mixing rate of organic fertilizer except rice bran and mustard cake. Averaged across three seasons, 10 to 30% cow-dung, rice straw organic fertilizer, vermicompost, 10% poultry litter and 20 to 30% rice bran with both types of soil was found suitable for seedling mat and seedling height. However, seedling varied among the organic fertilizers with both types of soil in the order of cow-dung > rice bran > vermicompost > poultry liter > rice straw organic fertilizer > mustard cake. Clay loam soil showed better performance on rolling quality over sandy loam soil.

Keywords: rice transplanter; organic fertilizer; rolling up; seedling mat; seedling height

Rice is the major agricultural product in Bangladesh, capturing the 75 and 63% of the total crop production and sales, respectively and 75% of the total cultivated area (Klytchnikova, Diop 2006). Though mechanization is quite less in Bangladesh compared to other neighbouring countries, it is gaining pace with time. Most importantly, there are no other better options than to go for mechanized agriculture. The total labour requirement for rice production in 1 ha of land is about 650–700 man-hrr of which 185–200 man-hr were consumed by seedling raising and transplanting which is 28.5% of the total labour requirement (Islam et al,. 2015).

Mechanization of rice cultivation, including seedling raising and transplanting, is improving in Bangladesh in order to reduce the cost of production. Mechanical transplanting requires considerably less time and labour (1–2 ha·person^{-1}·day^{-1}) than manual transplanting (0.07 ha·person^{-1}·day^{-1}) (Bell et al. 2003). In mechanical transplanting, 15–25 days old mat type seedlings are used normally. Mat type seedlings are raised either on plas-

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tic tray (280 × 580 × 25 mm) or on a polythene sheet with the help of frames. The mat type seedlings are raised with 20–25 mm thick well sieved soil layer mixed with organic manure placed in trays or over polythene sheets. The mat thickness for best results of seedling raising is about 20 mm (Anoopet al. 2007). For mechanical transplanting, the seedling that must forms a mat of its root system is needed. Seeding growing media in the tray has great influence on seedling quality, seedling strength and rolling capacity of the seedling mat and hence on plant establishment. Sufficient strength of the seedling mat is required for rolling up. Rolling quality of the seedling mat is important parameter to carry seedling from nursery bed to the rice field and to feed in the seedling tray of rice transplanter. Haytham et al. (2010) noticed that rolling up of the seedling mat is important to reduce the seedling volume that helps to carry bulk volume to the main field. Contrary to, appropriate seedling height is important to build seedling mat with sufficient strength for rolling up which helps to minimize missing hills by reducing buried hills. Dhananchezhiyan et al. (2013) found maximum. seedling height 170.6 mm under different organic soil media whereas optimum seedling height was 120 mm (CAME 2007).

In this study, the effect of soil, organic fertilizer and rate of mixture on rolling quality of the seedling mat, seedling strength and seedling height were observed with the specific objectives of:

– to observe the effect of growing media on mat type seedling for mechanical rice transplanting;
– to asses quality of seedling in terms of mechanical and agronomical characteristics;
– to select better growing media for quality seedling.

MATERIAL AND METHODS

The study was conducted in the Farm Machinery and Post-harvest Technology Division, BRRI, Gazipur during the irrigated dry season (Boro 2012-List of the three main factors characters of the experiment 13 and Boro 2013-14) and non-irrigated wet season (Aman 2013) with the following treatments. Seedling raised on plastic tray using two types of soil incorporation with different organic fertilizer at different rate of mixture.

Experimental design and treatments. Three factors: soil type (Factor A), organic fertilizer (Factor B) and rate of mixture (Factor C) were arranged in a randomized complete block (RCB) design with three replications (Table 1).

General information of the experiments. Boro and Aman season represent the cold and hot condition to raise seedling. Fig. 1 represented the temperature during the seedling growing period. Different experimental information is presented in Table 2.

Sample preparation and seedling raising on plastic tray. Sandy loam and clay loam soil and organic matters (cow dung, mustard cake, rice straw organic fertilizer, rice bran, poultry litter and vermicompost) were dried separately in the sun and sieved after grinding to remove clod, crop residues and weeds. Organic

Table 1. List of the three main factors characters of the experiment

Soil type (Factor A)	Organic fertilizer (Factor B)	Rate of mixture (Factor C)
Sandy loam	cow dung	0.0% (Control)
Clay loam	mustard cake	10% organic fertilizer
	rice straw organic fertilizer	20% organic fertilizer
	rice bran	30% organic fertilizer
	poultry litter	40% organic fertilizer
	vermicompost	

Table 2. General information of the experiment

Season	Variety	1,000 grains weight* (g)	Soaking date	Sowing date	Germination (%)
Boro/2012–13	BRRI dhan28	22.80	30 Nov 2012	05 Dec 2012	91
Aman/2013	BRRI dhan49	20.50	14 Aug 2013	18 Aug 2013	95
Boro/2013–14	BRRI dhan29	23.20	21 Dec 2013	26 Dec 2013	89

*weight measured at 14% moisture content

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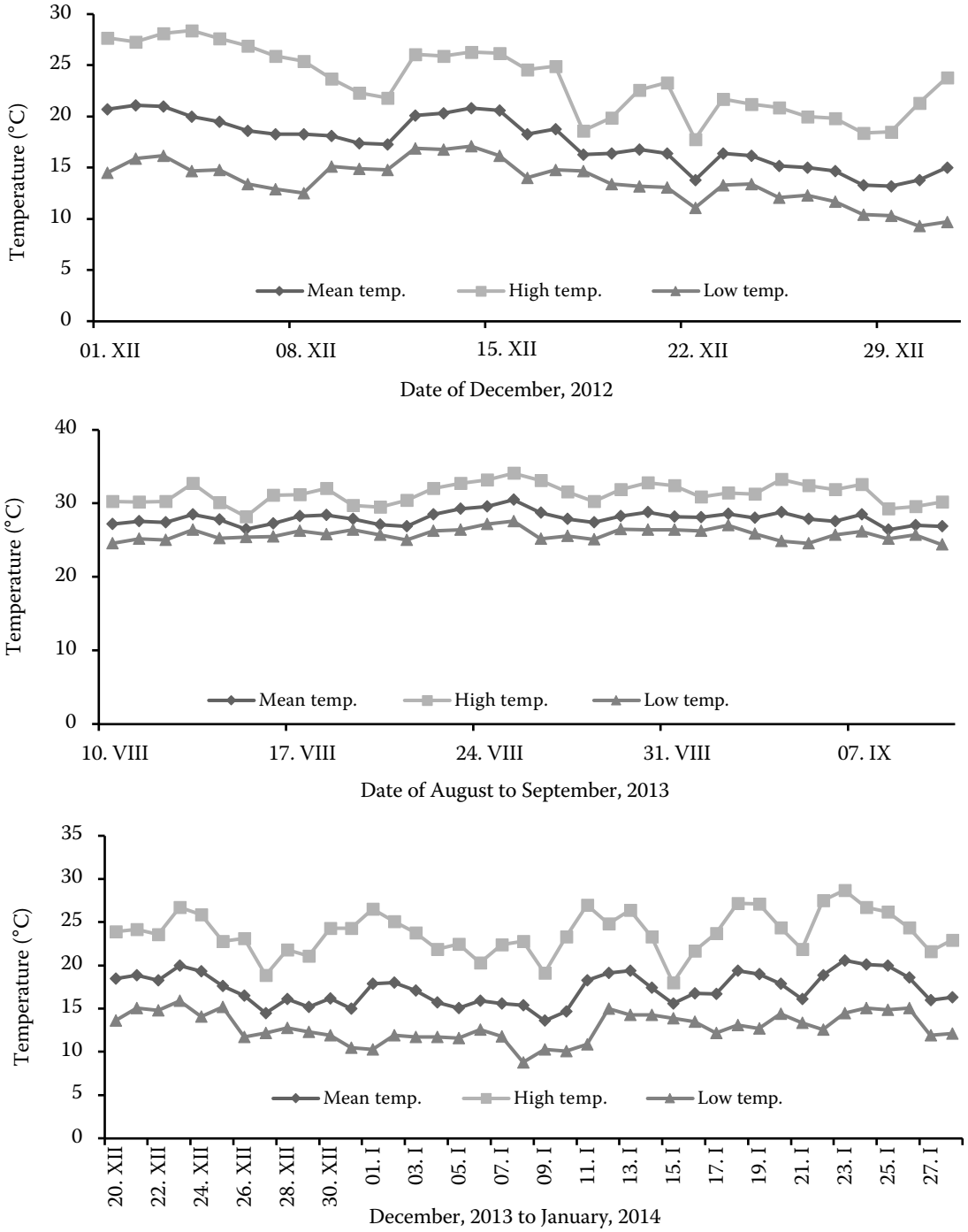

Fig. 1. Temperature during seedling growing seasons

matter mixed weight basis with the soil sample at the designed rate. Seedling tray filled up with mixed soil at a thickness of 20 mm. 140 g pre-germinated seeds were spread in each tray. After sowing, soil mixture was spread over the seeds to 3–4 mm thick.

Data collected. Based on objectives of the study, the data of seedling height were measured after 25 and 18 days of sowing during Boro and Aman season, respectively. Rolling capacity of the seedling mat was observed under different growing media. Randomly twenty plants were collected and dried in the oven for seedling strength measurement. Rolling quality of the seedling mat were measured in terms of scored 10 for excellent (no crack during rolling), 8 for good (single and minor crack), 6 for medium (more than one crack but possible to roll

https://doi.org/10.17221/79/2016-RAE

Fig. 2. Rolling quality of the seedling mat

up: medium crack), 4 for bad (more than one crack and difficult to roll up: major crack), 2 for very bad (more than one and large size crack and very difficult to roll up: extreme crack) and 1 for not possible to roll up in any way (Fig. 2).

RESULTS

Rolling quality of the seedling mat

Combined effect of soil, organic fertilizer and rate of mixture. Rolling quality of the seedling mat did not vary significantly with the 3-way interaction of soil, organic fertilizer and rate of mixture during the three growing seasons (Table 3).

Interaction effect of soil and organic fertilizer. Cow dung and rice bran with both sandy clay loam and clay loam soil and rice straw organic fertilizer, poultry litter and vermicompost with clay loam soil showed significantly better performance on rolling quality (6 to 6.4 out of 10) during Boro/2012-13 season (Table 4). In Aman/2013 season, cow dung and rice bran with sandy loam soil showed significant performance (6.93 to 7.6 out of 10 points) followed by rice bran and rice straw organic fertilizer with clay loam soil (6.3 to 6.6 out of 10 points). In Boro/2013-14 season, rice bran with clay loam soil showed significant better performance (8.80 out of 10 points) followed by cow-dung with both type of soil, vermicompost and rice straw based organic fertilizer with clay loam soil (6.6 to 6.8 points).

Interaction effect of organic fertilizer and rate of mixture. Rolling quality of the seedling mat decreased with the increased of organic fertilizer except rice bran. Considering the mixture rate of organic fertilizer, significantly higher rolling quality (7.0 to 7.7 out of 10 points) was observed for 10 to 30% cow dung, 30 to 40% rice bran and 10% vermicompost during Boro/2012-season. In Aman/2013 season, significantly higher rolling quality was observed for control along with 10 to 30% of cow dung, 10% of rice straw organic fertilizer, 10 to 30% of rice bran and 10% of vermicompost (7.0 to 8.0 points). Contrary to, 10 to 20% of cow dung, 10% of rice straw organic fertilizer, 30 to 40% of rice bran and 10 to 20% of vermicompost demonstrated higher rolling quality of the seedling mat (7.7 to 8.3 points) during Boro/2013-14 (Table 5).

Single effect of soil, organic fertilizer and rate of mixture. CLS soil gave better quality of seedling mat during Boro season whereas SLS during Aman season. Cow dung, rice bran and vermicompost during the three seasons and rice straw organic fertilizer during Aman season gave significantly better quality (Fig. 3). Contrary to, rolling quality decreased with the increased of mixing rate whereas lowest rolling quality was observed for 40% mixing of organic fertilizer with both type of soil for seedling preparation.

Seedling height

Combined effect of soil, organic fertilizer and rate of mixture. During Boro/12-13 season, 10 to 20% cow dung (92–96 mm) with sandy loam soil (SLS) and clay loam soil (CLS), 10 to 20% of mustard cake with SLS (111 to 118 mm), 30 to 40% rice straw organic with SLS (90 to 92 mm) and 20% with CLS (91 mm), 20% rice bran with SLS (102 mm), 10 to

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Table 3. Rolling quality of seedling mat as affected by soil, organic fertilizer and rate of mixture

Soil	Organic fertilizer (%)	Organic fertilizer (OF)					
		CD	MC	RSO	RB	PL	VC
Boro/2012-13 season							
SLS	0	6.00	6.00	5.33	5.33	4.67	6.67
	10	8.00	3.33	5.33	5.33	6.00	6.67
	20	7.33	1.67	4.67	4.67	3.33	6.00
	30	5.33	1.67	4.67	7.33	2.00	5.33
	40	3.33	1.33	3.33	7.33	1.33	3.33
CLS	0	8.00	8.00	7.33	7.33	7.33	7.33
	10	7.33	4.67	7.33	4.67	6.67	8.00
	20	8.00	3.33	6.67	5.33	7.33	6.67
	30	5.33	1.67	5.33	7.33	6.67	6.67
	40	3.33	1.33	3.33	6.67	3.33	3.33
LS	S = **, OF = **, RM = **, S × OF = **, S × RM = **, OF × RM = **, S × OF × POF = NS						
$LSD_{0.05}$	S = 0.29, OF = 0.51, RM = 0.47, S × OF = 0.72, S × RM = 0.66, OF × RM = 1.14						
% of CV	18.78						
Aman/2013 season							
SLS	0	8.00	8.67	8.00	8.00	7.33	8.00
	10	8.67	5.33	7.33	8.00	6.67	6.67
	20	7.33	1.00	6.00	8.67	4.67	6.00
	30	6.00	1.67	5.33	8.00	5.33	4.00
	40	4.67	1.33	4.00	5.33	4.67	4.67
CLS	0	6.67	6.67	8.00	6.67	7.33	7.33
	10	7.33	1.67	8.67	6.67	6.67	7.33
	20	6.67	1.33	7.33	6.67	4.67	6.67
	30	5.33	1.33	5.33	6.67	5.33	5.33
	40	4.67	2.00	4.00	4.67	4.67	4.67
LS	S = *, OF=**, RM =**, S × OF = **, S × RM = NS, OF × RM = **, S × OF × RM = NS						
$LSD_{0.05}$	S = 0.28, OF = 0.49, RM = 0.45, S × OF = 0.69, OF × RM = 1.09						
% of CV	16.45						
Boro/2013-14 season							
SLS	0	5.33	5.33	6.00	5.33	4.67	6.67
	10	7.33	1.33	7.33	4.67	5.33	8.00
	20	8.67	1.00	6.67	4.67	2.67	7.33
	30	8.00	1.00	4.00	6.67	2.00	5.33
	40	4.67	1.00	1.00	6.67	2.67	3.33
CLS	0	8.67	8.67	8.67	8.67	7.33	8.00
	10	8.67	2.33	9.33	8.67	6.00	8.67
	20	8.00	1.00	8.67	9.33	4.67	8.00
	30	4.67	1.00	5.33	8.67	1.67	6.00
	40	3.33	1.00	1.00	8.67	1.67	2.67
LS	Soil (S) =**, OF = **, RM = **, S × OF=**, S × RM = **, OF × RM = **, S × OF × RM = NS						
$LSD_{0.05}$	S = 0.31, OF = 0.53, RM = 0.49, S × OF = 0.75, S × RM = 0.69, OF × RM = 1.19						
% of CV	19.29						

CLS – clay loam soil; SLS – sandy loam soil, S – soil; CD – cow dung; MC – mustard cake; RSO – rice straw organic; RB – rice bran; PL – poultry litter; VC – vermicompost; OF – organic fertilizer; RM – rate of mixture (%); NS – not significant; * – significant at 5 %;**-significant at 1 %; LS – level of significance; CV – coefficient of variation

https://doi.org/10.17221/79/2016-RAE

Table 4. Rolling quality of the seedling mat as affected by soil type and organic fertilizer

Organic fertilizer	Boro/2012-13		Aman/2013		Boro/2013-14	
	SLS	CLS	SLS	CLS	SLS	CLS
CD	6.00	6.40	6.93	6.13	6.80	6.67
MC	2.80	3.80	3.60	2.60	1.93	2.80
RSO	4.67	6.00	6.13	6.67	5.00	6.60
RB	6.00	6.27	7.60	6.27	5.60	8.80
PL	3.47	6.27	5.73	5.73	3.47	4.27
VC	5.60	6.40	5.87	6.27	6.13	6.67
LS	S = **, OF = ** and S × OF = **		S = *, OF= ** and S × OF = **		S = **, OF = ** and S × OF = **	
$LSD_{0.05}$	S = 0.29, OF = 0.51, S × OF = 0.72		S = 0.28, OF = 0.49, S × OF = 0.69		S = 0.31, OF = 0.53, S × OF = 0.75	
% of CV	18.78		16.45		19.29	

for bbreviations see Table 3

30% poultry litter with SLS (111 to 113 mm) and 10% with CLS (104 mm) and 10% vermicompost with SLS (98 mm) and 10 to 20% with CLS (93 to 100 mm) produced higher seedling height over other combinations of the respective organic fertilizer. In Aman/2013 season, significantly higher seedling height was observed for 10 and 40% of cow-dung, 40% of rice straw organic, 20% of rice bran, 10 to 20% of vermicompost with SLS and 10% of poultry litter with both types of soil (234 to 249 mm). On the other hand, 30% of rice bran and poultry litter with SLS and CLS (155 to 156 mm) produced significantly higher seedling height during Boro/2013-14 season (Table 6).

Interaction effect of soil and organic fertilizer. Cow-dung and poultry litter showed significantly higher seedling height (91.33 to 96.27 mm) followed by vermicompost with both types of soil, rice straw organic fertilizer and mustard cake with SLS (82.87 to 88.27 mm) during Boro/2012-13 season. In Aman/2013 season, all organic fertilizer except mustard cake produced significantly higher seedling height with SLS whereas CLS showed significantly higher with only poultry litter (216 to 224 mm). In Boro/2013-14 season, poultry litter with CLS showed significantly higher seedling height (123.39 mm) followed by cow-dung and rice bran also with CLS (Table 7).

Interaction effect of organic fertilizer and rate of mixture. Significantly higher seedling height was observed for 10 to 30% of poultry litter (100.3 to 108.0 mm) followed by 10 to 20% and 40% of cow-dung, 10% of mustard cake and 10 to 20% of vermicompost (94.33 to 98.3 mm) during Boro/2012-13 season. In Aman/2013 season, 10% mixture of poultry litter produced higher seedling height (242.07 mm) followed by 40% of rice straw organic fertilizer (227.27 mm) which was similar with 10 to 40% of cow dung, 20 to 30% of rice straw organic fertilizer, 20 to 40% of rice bran and poultry litter and 20% of vermicompost (218.3 to 226.2 mm). On the other hand, 30% rice bran produced significantly more seedling height (140.60 mm) followed by 30% of cow-dung (119.50 mm)which was similar with 10 and 40% of cow-dung and rice bran and 20% of poultry litter (107.97 to 117.27 mm) during Boro/2013-14 season (Table 8).

Single effect of soil, organic fertilizer and rate of mixture. SLS gave higher seedling height during Boro/2012-13 and Aman/2013 seasons whereas CLS during Boro/2013-14 season. Cow-dung and vermicompost during Boro/2012-13 season, cow-dung, rice straw, rice bran, poultry litter and vermicompost during Aman/2013 season and cow-dung and rice bran during Boro/2013-14 season provided higher seedling height. Contrary to, 10% mixing rate demonstrated significantly higher seedling height irrespective of seasons (Fig. 4).

DISCUSSION

In the present study, combined, interaction and single effect of soil type, organic fertilizer and mixing rate was observed during the both dry (Boro) and wet (Aman) seasons. In Boro seasons, cow dung and rice bran showed better performance with both types of soil because roots growth influenced by these to make compact mat anchoring the soil fol-

https://doi.org/10.17221/79/2016-RAE

Table 5. Rolling quality of the seedling mat as affected by organic fertilizer and rate of mixture

Organic fertilizer	Rate of mixture of the organic fertilizer				
	0%	10%	20%	30%	40%
Boro/2012–13					
CD	7.0	7.7	7.7	5.3	3.3
MC	7.0	4.0	2.5	1.7	1.3
RSO	6.3	6.3	5.7	5.0	3.3
RB	6.3	5.0	5.0	7.3	7.0
PL	6.0	6.3	6.3	4.3	2.3
VC	7.0	7.3	6.3	6.0	3.3
LS	OF = **, RM = **, OF × RM = **				
$LSD_{0.05}$	OF = 0.51, RM = 0.47 and OF × RM = 1.14				
% of CV	18.78				
Aman/2013					
CD	7.3	8.0	7.0	5.7	4.7
MC	7.7	3.5	1.2	1.5	1.7
RSO	8.0	8.0	6.7	5.3	4.0
RB	7.3	7.3	7.7	7.3	5.0
PL	7.3	6.7	4.7	5.3	4.7
VC	7.7	7.0	6.3	4.7	4.7
LS	OF = **, RM = **, OF × RM = * *				
$LSD_{0.05}$	OF = 0.49, RM = 0.45, OF × RM = 1.09				
% of CV	16.45				
Boro/3013–14					
CD	7.0	8.0	8.3	6.3	4.0
MC	7.0	1.8	1.0	1.0	1.0
RSO	7.3	8.3	7.7	4.7	1.0
RB	7.0	6.7	7.0	7.7	7.7
PL	6.0	5.7	3.7	1.8	2.2
VC	7.3	8.3	7.7	5.7	3.0
LS	OF = **, RM = **, OF × RM = **				
$LSD_{0.05}$	OF = 0.53, RM = 0.49, OF × RM = 1.19				
% of CV	19.29				

CLS – clay loam soil; SLS – sandy loam soil, S – soil; CD – cow dung; MC – mustard cake; RSO – rice straw organic; RB – rice bran; PL – poultry litter; VC – vermicompost; OF – organic fertilizer; RM – rate of mixture (%); NS – not significant, * – significant at 5 %;**-significant at 1 %; LS – level of significance; CV – coefficient of variation

lowed by vermicompost. Aman season showed better performance on rolling quality of the seedling mat irrespective of soil types and organic fertilizer with the rate of mixture of 0 to 30% except mustard cake because of high ambient temperature. Physical and chemical compositions of different organic fertilizer likely affect the roots growth and roots strength to fix the soil of tray (Sasaki et al. 1981). Rolling quality of the seedling mat decreased with the increased of organic fertilizer except rice bran because bonding strength of soil decreased with the increased of organic fertilizer. The decrease of soil strength with the increased of organic inputs agrees with other studies (Arthur et al. 2012; Schjonning et al. 2007). Mustard cake, poultry litter and rice straw organic fertilizer gave poor bonding of the seedling mat in both seasons because of restricting the roots growth and loosen the bonding of the tray

https://doi.org/10.17221/79/2016-RAE

Table 6. Seedling height (mm) as affected by soil, fertilizer and rate of mixture

Soil type	Organic fertilizer (%)	Name of organic fertilizer (OF)					
		CD	MC	RSO	RB	PL	VC
Boro/2012-13							
SLS	0	98.3	96.0	82.7	76.7	75.3	79.0
	10	97.3	118.3	85.3	80.0	111.7	98.3
	20	92.7	111.0	79.7	101.7	109.7	91.0
	30	84.0	83.3	90.3	71.0	113.0	86.3
	40	97.7	5.7	92.3	73.3	66.3	86.7
CLS	0	96.7	110.0	78.7	79.0	87.7	80.3
	10	94.7	78.3	82.7	86.0	104.3	92.7
	20	96.0	6.0	91.3	63.7	91.0	99.7
	30	75.7	6.0	77.0	52.7	98.7	82.3
	40	93.7	5.0	84.0	55.0	99.7	82.3
LS	S = **, OF = **, RM = **, S × OF = **, S × RM = **, OF × RM = **, S × OF × RM = *						
$LSD_{0.05}$	S = 2.23, OF = 3.86, RM = 3.52, S × OF = 5.46, S × RM = 4.98, OF × RM = 8.63, S × OF × RM = 12.21						
% of CV	9.12						
Aman/2013							
SLS	0	198.1	212.1	213.9	211.9	217.4	208.73
	10	234.8	203.9	209.1	220.3	234.2	247.37
	20	205.5	6.0	216.0	240.2	214.2	245.00
	30	223.2	5.0	222.4	204.9	225.3	220.33
	40	239.4	4.3	244.9	227.1	211.1	197.00
CLS	0	191.7	217.7	169.7	198.3	184.0	179.73
	10	216.4	5.0	208.9	192.8	249.9	172.00
	20	209.7	4.3	210.5	210.7	224.1	204.80
	30	204.9	5.7	225.6	228.5	198.7	202.73
	40	213.0	5.3	209.6	215.3	225.5	225.80
LS	S = *, OF = **, RM = ** S × OF = **, S × RM = NS, OF × RM = **, S × OF × RM = *						
$LSD_{0.05}$	S = 3.67, OF = 6.35, RM = 5.80, S × OF = 8.98, S × RM = 8.20, OF × RM = 14.20 and S × OF × RM = 20.09						
% of CV	6.55						
Boro/13-14							
SLS	0	62.4	66.5	63.7	62.4	62.3	67.00
	10	77.9	77.2	70.7	75.0	78.7	80.72
	20	91.9	4.0	72.2	89.5	83.4	77.73
	30	104.5	4.3	70.2	155.7	4.7	71.37
	40	106.7	4.7	5.7	106.2	4.3	65.88
CLS	0	74.0	78.3	65.7	75.3	85.9	67.00
	10	99.2	112.2	72.1	87.9	113.5	87.06
	20	137.3	5.3	73.6	130.1	132.5	78.00
	30	134.5	8.3	71.7	125.5	156.1	74.70
	40	124.9	8.0	7.7	128.3	128.9	64.45
LS	S = **, OF = **, RM =**, S × OF = **, S × RM= **, OF × RM = **, S × OF × RM = **						
$LSD_{0.05}$	S = 1.95, OF = 3.37, RM = 3.08, S × OF = 4.77, S × RM = 4.35, OF × RM = 7.54, S × OF × RM = 10.66						
% of CV	8.65						

CLS – clay loam soil; SLS – sandy loam soil, S – soi; CD – cow dung; MC – mustard cake; RSO – rice straw organic; RB – rice bran; PL – poultry litter; VC – vermicompost; OF – organic fertilizer; RM – rate of mixture (%); NS – not significant, * – significant at 5 %;**-significant at 1 %; LS – level of significance

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Table 7. Seedling height (mm) as affected by soil and fertilizer

Organic fertilizer	Seedling height (mm)					
	Boro/2012-13		Aman/2013		Boro/2013-14	
	SLS	CLS	SLS	CLS	SLS	CLS
CD	94.0	91.3	220.2	207.1	88.7	114.0
MC	82.9	41.1	86.3	47.6	31.3	42.4
RSO	86.1	82.7	221.3	204.9	56.5	58.2
RB	80.5	67.3	220.9	209.1	97.8	109.4
PL	95.2	96.3	220.5	216.5	46.7	123.4
VC	88.3	87.5	223.7	197.0	72.5	74.2
LS	S = **, OF = ** and S × OF = **		S = **, OF = ** and S × OF = **		S = **, OF = **, S × OF = **	
$LSD_{0.05}$	S = 2.23, OF = 3.86 and S × OF = 5.46		S = 3.67, OF = 6.35 and S × OF = 8.98		S = 1.95, OF = 3.37 and S × OF = 4.77	
% of CV	9.12		6.55		8.65	

CLS – clay loam soil; SLS – sandy loam soil, S – soil; CD – cow dung; MC – mustard cake; RSO – rice straw organic; RB – rice bran; PL – poultry litter; VC – vermicompost; OF – organic fertilizer; RM – rate of mixture (%); NS – not significant, * – significant at 5 %; **– significant at 1 %; LS – level of significance

soil. Haytham et al. (2010) reported that rice straw seed bed can be rolled up easily that helps to reduce working hours by one-third.

Seedling height varied with season, seedling growing media, soil fertility, ambient temperature, phenotypic characteristics of the variety etc. Aman

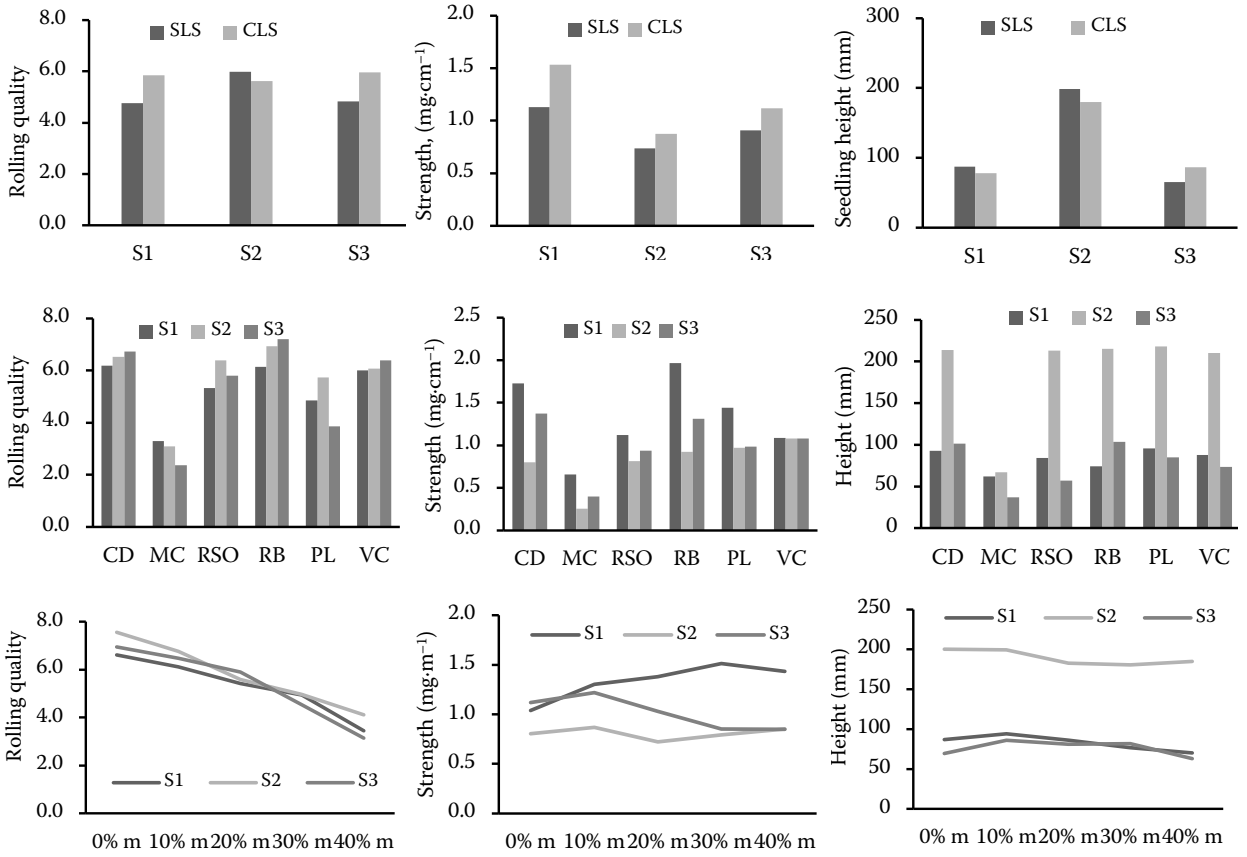

Fig. 3. Single effect of soil, organic fertilizer and rate of mixture on rolling quality of seedling mat, seedling strength and heigh
S1 – Boro/2012-13 season, S2 – Aman/2013 season and S3 – Boro 2013-14/season; for other abbreviations see Table 6

https://doi.org/10.17221/79/2016-RAE

Table 8. Seedling height (mm) as affected by organic fertilizer and rate of mixture

Organic fertilizer	Seedling height (mm)				
	Rate of mixture of the organic fertilizer				
	0%	10%	20%	30%	40%
Boro/2012-13					
CD	97.50	96.00	94.33	79.83	95.67
MC	103.0	98.3	58.50	44.67	5.33
RSO	80.67	84.00	85.50	83.67	88.17
RB	77.83	83.00	82.67	61.83	64.17
PL	81.50	108.00	100.3	105.83	83.00
VC	79.67	95.5	95.33	84.33	84.50
LS	OF = **, RM = **, OF × RM = **				
LSD0.05	OF = 3.86, RM = 3.52, OF × RM = 8.63				
% of CV	9.12				
Aman/2013					
CD	194.90	225.58	207.60	214.05	226.2
MC	214.87	104.47	5.17	5.33l	4.83
RSO	191.80	209.00	213.27	223.98	227.27
RB	205.07	206.53	225.45	216.70	221.20
PL	200.72	242.07	219.17	212.00	218.30
VC	194.23	209.68	224.90	211.53	211.40
LS	OF = **, RM = **, OF × RM = **				
LSD0.05	OF = 6.35, RM = 5.80 and OF × RM = 14.20				
% of CV	6.55				
Boro/2013-14					
CD	68.18	88.57	114.60	119.50	115.77
MC	72.37	94.70	4.67	6.33	6.33
RSO	64.67	71.40	72.90	70.97	6.67
RB	68.83	81.43	109.80	140.60	117.27
PL	74.10	96.10	107.97	80.40	66.60
VC	67.00	83.89	77.87	73.04	65.17
LS	OF =* *, RM = ** and OF × RM = **				
LSD0.05	OF = 3.37, RM = 3.08 and OF × RM = 7.54				
% of CV	8.65				

CLS – clay loam soil; SLS – sandy loam soil, S – soi; CD – cow dung; MC – mustard cake; RSO – rice straw organic; RB – rice bran; PL – poultry litter; VC – vermicompost; OF – organic fertilizer; RM – rate of mixture (%); NS – not significant, * – significant at 5 %; ** significant at 1 %; LS – level of significance; CV – coefficient of variance

season produced higher seedling height over Boro season. In Aman season, seedling height increased with the increased of organic fertilizer mixture except mustard cake because mustard cake decomposed with irrigation water that might produce toxic substance. Seedling height increased (80 to 156 mm) up to 30% organic fertilizer mixture with both types of soil types during Boro season. Mamun et al. (2013) reported that seedling of BRRI dhan45 and BRRI dhan29 become 110 mm height

https://doi.org/10.17221/79/2016-RAE

during Boro season which is quite similar with the present study of Boro season.

CONCLUSION

Quality seedling in terms of rolling capacity, seedling strength and seedling height are important factor for large scale used of rice transplanter. Rolling capacity decreased and seedling height increased with increased of mixing rate except rice bran and mustard cake. Clay loam soil showed better performance on rolling quality of the seedling mat over sandy loam soil. During Aman season, 10 to 30% of cow dung, poultry litter, rice bran, vermicompost and rice straw organic fertilizer along with clay loam and sandy loam soil showed better performance to raise seedling whereas 10 to 20% cow-dung, rice straw organic fertilizer and vermicompost and 10% mustard cake and poultry liter showed better performance during Boro seasons.

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Received for publication July 17, 2016
Accepted after corrections January 1, 2017