Original Research Article

Effect of Planting Methods and Weed Management Practices on Growth and Yield of Paddy (*Oryza sativa* L.)

ABSTRACT

The trial was conducted in the plot 11 in of Crop Research Farm, Department of Agronomy of Naini Agricultural Institute, SHUATS, Prayagraj (U.P), during Kharif 2021 on topic entitiled "Effect of Planting Methods and Weed management Preactices on Growth and Yiled of Paddy (Oryza sativa)". The experiment consists of three different planting methods i.e., Direct seeded rice, Transplanted rice and SRI method, and three different weed management practices i.e., Hand weeding (twice), Oxadiazon 25 EC (as Pre emergence) at 250g/ L (2L/ha) and Pyrazosulfuron ethyl 10% WP at 20g/ha (as Post Emergence) and a control plot laid out in randomized block design with ten different treatment combinations which is replicated thrice. The results revealed that at harvest significantly, higher growth attributes like plant height (117.28 cm), Number of tillers (38), plant dry weight (56.36 g/hill) at harvest is recorded in treatment number 7 with a combination of SRI method of planting and Hand weeding twice at critical crop weed competition. Significantly, higher yield attributes like number of effective tillers/ hill (35), number of panicles/ plant (44), number of grains per panicle (216.6), test weight (25 g), grain yield (5.1 t/ha) and straw yield (8.1 t/ha) was highest in the same treatment.

Conclusion: From the experimental results it is revealed that best planting method was SRI method in Rice.

Key words: Direct seeded rice, Growth, Paddy, SRI method and Yiled.

1. INTRODUCTION

Rice (Oryza sativa L.) belongs to family Poaceae. It is the most important and extensively grown in tropical and subtropical regions of the world, and staple food for more than 60 per cent of the world population. India shares around 21 percent of global rice production from about 28 percent of rice area. Rice is cultivated world-wide over an area of about 160.68 million ha with an annual production of about 650.19 million tons. Rice "Crop of Millennium" contributing 471.09 million tones gaining worldwide. In India rice is grown in 43.86 million ha, the production level is 104.80 million tones and the productivity is about 2390 kg/ha (Agricultural Statistics at a glance- 2015). Utter Pradesh is an important rice growing state in the country. The area and production of rice in this state is about 5.98 million hectares and 14.64 million tonnes respectively with an average productivity of 2.447 t/ha **(GOI, 2016).** Production of rice rank

second among the food grain and half of the world population receiving the highest (26.2%) calories intake from it in the developing countries of their dietary protein (FAO, 2009). Rice is one of the main-source of carbohydrates for nearly one half of the world population. India has a long history of rice cultivation and stands first in rice area and second in rice production, after china **(Yadav *et al*., 2010).** Rice is one of the most important cereal crops of kharif season. Rice is a short day plant under diverse climatic and edaphic conditions. It is tolerant to a range of soils with pHa from 4.5-8.5 can be grown successfully on saline or sodic soils.

Transplanting is the oldest and popular method of rice establishment which is effective in reducing weed density. Puddling and submerged conditions under transplanting reduce weed germination. The competitive advantage of transplanted rice over direct seeded rice is due to the use of 4-5 weeks old seedlings (20-30 cm tall) in transplanted rice Transplanting shock occurs when the seedlings are pulled out from the nursery and planted in new environment, for recovery from shock it will take minimum of 5-7 days under topics. It is common in transplanted rice. The seed rate recommended for this is 30-60 kg/ha. Seedlings are transplanted after 20-25 days after sowing at a spacing of 20*15 cm.

Efforts to popularize SRI [System of Rice Intensification] were revived in many countries including India since 2003. SRI mainly emphasizes on utilizing early growth vigor of seedlings, facilitates less competition for light and nutrients, enhances resource use efficiency (seeds, water, fertilizer, pesticides) and brings down over dependence on chemical fertilizers, breaking soil anoxia condition and promoting healthy root growth and increased soil microbial activity. SRI method has an edge over the former methods as water-saving does not have penalty on yields in this system. SRI involves the use of certain management practices, which together provide better growing conditions for rice plants, particularly in root zone, then those plants grown under traditional practices. SRI was developed in Madagascar in the early 1980s by Father Henri de Lauhanie, a Jesuit priest. There are 6 major practices in SRI, they are transplanting young seedlings (8-15 days old), planting single seedling, square planting with wider spacing between plants, lesser seed rate (5-8 kg/ha), moist but unflooded soil condition and weeding is done by conoweeder. These practices seem to reduce the risk of crop failure.

2. Materials and Methods

The experiment was conducted during the *kharif* season of 2021 at the Crop Research Farm, Department of Agronomy, Naini Agricultural Insititute, Sam Higginbottom University of Agriculture, Technology and Sciences (SHUATS), Prayagraj. The Crop Research Farm is situated at 25^0 57’ N latitude, 87^0 19’ E longitude and at an altitude of 98 m above mean sea level. This area is situated on the right side of the river *Yamuna* and by the opposite side of Prayagraj City. All the facilities required for crop cultivation were available. Prayagraj has a subtropical and semi-arid climatic condition, with both extremes of temperature, *i.e*. winter and summer. The meteorological data including the weekly average of maximum and minimum temperature, relative humidity, and rainfall recorded at the Agro Meteorological

Observatory Unit, School of Forestry and Environment Sciences, Sam Higginbottom University of Agriculture Technology & Sciences, Prayagraj (Allahabad) during the cropping period are presented in fig 1.

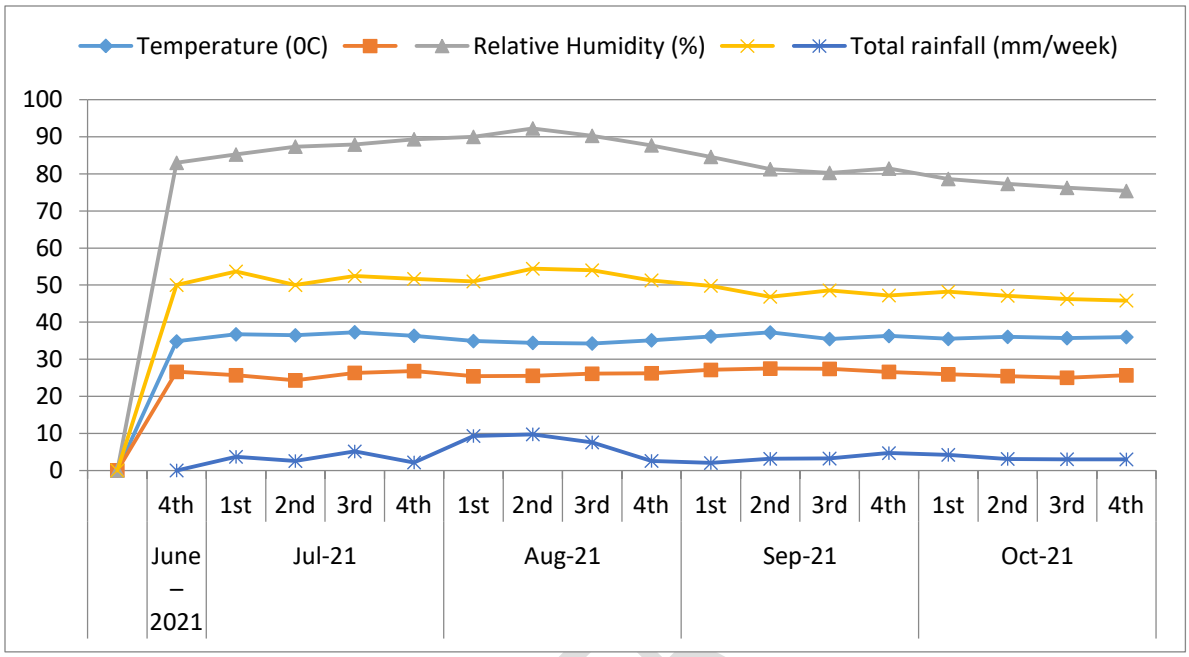

Fig 1:

The soil of the experimental field constituting a part of central Gangetic alluvium is neutral and deep. Pre- sowing soil samples were taken from a depth of 15 cm with the help of an auger. The composite samples were used for the chemical and mechanical analysis. The soil was sandy loam in texture, low in organic carbon and medium in available nitrogen, phosphorous and low in potassium. The mechanical, chemical and physico-chemical properties of the soil of experimental field along with the methods used for determination is presented in Table 1.

2.1. Mechanical analysis of soil during *Kharif* 2021

Table: 1 The mechanical analysis of soil (0-15 cm depth) is represented below

Particulars	Result (%)	Method (reference)
Silt	22.6%	
Sand	63%	(Bouyoucos 1962)
Clay	14.40%	

Texture class	Sandy loam

3.3.2 Chemical analysis of soil during *Kharif* 2021

Table: 2 Mechanical analysis of soil

Parameter	Result (unit)	Method	Reference
Available nitrogen	205.48 kg/ha	Alkaline Permanganate Method	Subbaiah and Asija, 1956
Available phosphorus	49.0 kg/ha	Olsen's Colorimetric Method	Olsen *et al.* 1954
Available potassium	312.2 kg/ha	NH4 leaching	Jackson, 1973
Organic carbon	0.49 (%)	Walkley and Black Method	Jackson, 1973
Ph	7.7	Glass electrode pH meter	Jackson, 1973
EC	0.50 (ds/m)	Method No. 4, USDA Hand book No.60	Richard, 1954

Chemical analysis of the soil (0-30 cm depth) is presented in Table 2

The experiment was laid out in Randomized Block Design. The treatment comprised of 3 different Planting methods and 3 different Weed management practices. There were 10 treatments and each replicated thrice. Treatments were randomly arranged in each replication, divided into thirty (30) plots.

3. RESULTS AND DISCUSSION

PRE HARVEST READINGS`

3.1 Plant Height

At 100 DAS/DAT, significantly maximum plant height was recorded with Treatment T_7 (SRI method + Hand weeding) *i.e*., 117.28 cm. **Rahman, 2001 and Sangsu *et al.*, 1999** reported that younger seedlings have more vigor, root growth and lesser transplant shock because of lesser leaf area during initial growth stages which stimulate the cell division causing more stem elongation and ultimately have might increase plant height where SRI method of transplanting was opted.

3.2 Number of Tillers/ m^2

At 100 DAS/DAT, significantly maximum number of tillers per hill was recorded with Treatment T_7 (SRI method + Hand weeding) *i.e*., 38.2. Tillering is an important factor which decides the numbers of

panicle /m^2 and ultimately the yield of rice. The practice of transplanting one young seedling per hill with wider spacing as this is done under SRI can result in a reduced transplanting injury, increased number of tillers **(Horie et al., 2004)** and minimizes the competition between plants (**Rabenandrasana, 1999**).

3.3 Plant dry weight (g/hill)

At 100 DAS/DAT, significantly maximum dry weight was recorded with Treatment T_7 (SRI method + Hand weeding) *i.e*., 56.36 g/hill. **Lu *et al*. (2004)** reported that a dense spacing increased the dry matter production of rice, in our study dry matter accumulation did not show any significant difference between transplanting and SRI cultivation.

Tab. 3 Effect of planting methods and weed management practices on growth attributes of paddy

TREATMENT COMBINATIONS	PLANT HEIGHT (CM)	NUMBER OF TILLERS (NO.)	PLANT DRY WEIGHT (G/HILL)
Direct seeded Rice + Hand weeding	78.70	24.5	40.26
Direct seeded Rice + Oxadiazon 25 EC (PE)	76.4	23.2	39.21
Direct seeded Rice + Pyrazosulfuron ethyl (PoE)	74.53	19.4	37.59
Transplanted Rice + Hand weeding	95.70	33.0	50.78
Transplanted Rice + Oxadiazon 25 EC (PE)	94.84	30.2	48.30
Transplanted Rice + Pyrazosulfuron ethyl (PoE)	92.51	28.4	47.56
SRI Method + Hand weeding	117.28	38.2	56.36
SRI Method + Oxadiazon 25 EC (PE)	115.65	34.4	55.92
SRI Method + Pyrazosulfuron ethyl (PoE)	110.7	32.8	54.11
Control [weed management practices]	91.81	25.6	45.49
F-test	S	S	S
SEm(±)	0.86	1.18	0.22
CD(5%)	2.57	3.51	0.82

POST HARVEST READINGS

3.4 Effective Tillers/hill

An appraisal review of the table shows that the Effective tillers per hill differed significant. The maximum number of effective tillers per hill was observed with Treatment 7 with SRI method + Hand weeding *i.e.,* 35.6. This is because of different spacing in different planting methods and weed density in different treatment combinations.

3.5 Number of panicles/ plant

Observation on number of grains per panicle in paddy as influenced by planting methods and weed management practices were recorded after harvest during *kharif* season of 2021 was statically analyzed. The maximum number of panicles per plant was observed with Treatment 7 with SRI method + Hand weeding *i.e.,* 44

3.6 Number of grains/Panicle

An appraisal review of the table shows that the grains per panicle differed significant. The maximum number of grains per panicle was observed with Treatment 7 with SRI method + Hand weeding *i.e.,* 216.67. **Ang et al. (2002)** obtained maximum filled grains per panicle from 40 cm× 40 cm spacing of the SRI.

3.7 Test weight (g)

Highest test weight was observed with Treatment 7 with SRI method + Hand weeding *i.e.,* 25. Concerning the 1000-grains weight, a study of **Bari (2004)** confirmed our observation about the only marginal impact of planting method on 1000-grains weight, while **Hossain et al. (2003**) and **Husain et al. (2004)** observed higher 1000-grains weight under SRI compared to the farmers' conventional transplanting practice.

Tab. 4 Effect of planting methods and weed management practices on yield attributes of paddy

Treatment combinations	Effective Tillers/ hill(No.)	Number of Panicles/ Plant(No.)	Number of grains/ Panicle(No.)	Test Weight (g)
Direct seeded Rice + Hand weeding	22	25	179.3	22.8
Direct seeded Rice + Oxadiazon 25 EC (PE)	20	22	167.67	22.6
Direct seeded Rice + Pyrazosulfuron ethyl (PoE)	16.3	20	160.67	22.1
Transplanted Rice + Hand	30.3	36	203.67	23.4

weeding				
Transplanted Rice + Oxadiazon 25 EC (PE)	27.3	34	186.3	23.1
Transplanted Rice + Pyrazosulfuron ethyl (PoE)	25.3	32	183	23.0
SRI Method + Hand weeding	35.6	44	216.67	25.0
SRI Method + Oxadiazon 25 EC (PE)	32.3	41	210	24.8
SRI Method + Pyrazosulfuron ethyl (PoE)	29.3	40	207.67	24.7
Control [weed management practices]	23	27.3	161.67	23.7
F-test	**S**	**S**	**S**	**S**
SEm(±)	**1.15**	**1.59**	**2.95**	**0.23**
CD(5%)	**3.42**	**4.73**	**8.79**	**0.69**

3.8 Grain yield (t/ha)

The maximum grain yield was observed with Treatment 7 with SRI method + Hand weeding *i.e.,* 5.1 t/ha. **Suryavanshi *et al.* (2012)** reported significantly higher grain yield in SRI compared to conventional transplanting. . Higher yield under SRI method was due to better crop growth and development resulting in to higher value of yield attributes which had direct bearing on the grain yield.

3.9 Straw yield (t/ha)

The maximum straw yield was observed with Treatment 7 with SRI method + Hand weeding *i.e.,* 8.1 t/ha**. Husain *et al*. (2003)** found 39 % higher straw yield in SRI compared to traditional methods.

Tab 5 Effect of planting methods and weed management practices on yield attributes of paddy

Treatment combinations	Grain yield (t/ha)	Straw yield (t/ha)	Harvest Index (%)
Direct seeded Rice + Hand weeding	3.7	5.6	39.9

Direct seeded Rice + Oxadiazon 25 EC (PE)	3.6	5.3	40.5
Direct seeded Rice + Pyrazosulfuron ethyl (PoE)	3.2	5.1	39.6
Transplanted Rice + Hand weeding	4.3	6.7	39.3
Transplanted Rice + Oxadiazon 25 EC (PE)	4.1	6.2	39.7
Transplanted Rice + Pyrazosulfuron ethyl (PoE)	4.0	6.2	40.3
SRI Method + Hand weeding	5.1	8.1	38.6
SRI Method + Oxadiazon 25 EC (PE)	4.6	7.4	38.2
SRI Method + Pyrazosulfuron ethyl (PoE)	4.5	7.1	38.6
Control [weed management practices]	3.8	5.8	39.7
F-test	**S**	**S**	**S**
SEm(±)	**1.59**	**0.20**	**1.18**
CD(5%)	**0.47**	**0.61**	**0.53**

4. CONCLUSION

The results revealed that at harvest significantly, higher growth attributes like plant height (117.28 cm), Number of tillers (38), plant dry weight (56.36 g/hill) at harvest is recorded in treatment number 7 with a combination of SRI method of planting and Hand weeding twice at critical crop weed competition. Significantly, higher yield attributes like number of effective tillers/ hill (35), number of panicles/ plant (44), number of grains per panicle (216.6), test weight (25 g), grain yield (5.1 t/ha) and straw yield (8.1 t/ha) was highest in the same treatment.

From the experiment it can be concluded that treatment 7 where SRI method of planting and hand weeding twice during critical crop weed competition was considered as best treatment combination with maximum grain yield (5.1 t/ha) and straw yield (8.1 t/ha). However, this experimental results were based on one-year trial, further trials are needed for conformity and recommendation.

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