

## Development of an experimental technique for rice transplanting by using "twisted rice straw ropes"

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### Abstract

*A series of experiments were conducted to introduce a new transplanting method using twisted rice straw ropes, with rice (Oryza sativa) variety AT 306.*

*Four treatments were tested in the first trial, namely the SRI method (T<sub>1</sub>), dapog (T<sub>2</sub>), broadcasting (T<sub>3</sub>) and twisted straw rope method (T<sub>4</sub>). Size of the straw rope was tested using three treatments in experiment 02, namely 5cm (T<sub>1</sub>), 7.5cm (T<sub>2</sub>) and 10cm straw ropes (T<sub>3</sub>). Urea application on straw ropes was tested in experiment 03, with urea treated (T<sub>1</sub>) and without urea treated (T<sub>2</sub>) straw ropes. There were three treatments and the control (T<sub>1</sub>, conventional planting method), seeds of cowpea incorporated into twisted straw ropes and placed in the field (T<sub>2</sub>), seeds incorporated into twisted straw ropes and kept for 2 days on a floor and then placed in the field (T<sub>3</sub>). Growth performances like plant height, number of leaves, number of tillers and shoot dry weight were continuously increased in twisted straw rope method than broadcasting and conventional row transplanting method. Yield performances also gave similar results as growth parameters. Results of experiment 01 revealed that twisted straw rope method was an effective and beneficial method for lowland rice. From experiment 02, it can be concluded, that 10cm straw ropes (T<sub>3</sub>) were better than other two sizes of ropes. Results of experiment 03 proved that the application of urea solution for twisted straw ropes before they were placed in the field had beneficial effects on growth and yield of rice.*

### Introduction

Rice is the staple food for a large number of people on the earth. Rapid growth of population has caused an urgent requirement for increasing the rice yield while cost of rice production is also parallelly increasing, especially in under developed countries. Scientists conduct their experiments using two approaches to fulfil this requirement by improving the genetic make up of rice plant and introducing more effective cultural practices to enhance the productivity. Some advantages of the twisted straw rope technique are minimize transplanting shock, protect seeds from birds or ants, reduce seedling dislocation due to run-off water compared to broadcasting methods, minimize the labour required for land preparation, transplanting and chasing birds etc, reduce the weed incidence and produce vigorous plantation (Datta, 1981).

### Materials and methods

The experiments were conducted at the research farm of the Faculty of Agriculture at Mapalana. Three experiments were conducted as lowland experiments and used the rice variety of AT 306. Newly harvested straw was twisted to make ropes. The crop was maintained following recommended cultural practices.

#### Lowland Experiments

Pot size of 11 litre (30cm diameter) were used. Each pot was filled up to 25cm height of paddy soil.

Experimental design was Randomized Complete Block Design (RCBD) with 5 replicates.

#### Experiment 01

Four treatments such as three different nursery practices followed by different transplanting methods and broadcasting were tested in relation to their growth and yield parameters.

T<sub>1</sub> - Wet bed nursery, field planting as SRI (transplanted 5 days old seedlings)

T<sub>2</sub> - Dapog nursery, normal transplanting, giving recommended spacing (transplanted 12 days old seedlings)

T<sub>3</sub> - Broadcasting

T<sub>4</sub> - Twisted straw rope method giving recommended spacing.

#### Experiment 02

Size of the straw rope was tested using three treatments such as

T<sub>1</sub> - 5cm

T<sub>3</sub> - 10cm diameter of twisted straw ropes.

T<sub>2</sub> - 7.5cm

#### Experiment 03

The two treatments were tested as

T<sub>1</sub> - Twisted straw ropes with urea treatment

T<sub>2</sub> - Twisted straw ropes without urea treatment

Half of the amount of urea in the basal dressing was used to treat straw ropes. (Basal dressing of urea 0.29108g/pots). Plant height, number of leaves/plant, number of tillers/plant or number of branches/plant and shoot dry weight were measured as growth parameters. Number of panicles/plant, number of spikelets/panicle, filled grain %, 1000 seed weight and yield (t/ha) were measured as yield parameters. In addition soil chemical properties (EC and pH) were measured up to 9 weeks after planting.

**Results and discussion**

**Growth and yield performances of rice**

**Experiment 01: Comparison of existing transplanting techniques with newly developed technique in relation to growth and yield performances**

Table 01: Plant height at 2, 4, 6, 8 and 10 weeks after planting.

Treatments	Plant height (cm)				
	2 weeks	4 weeks	6 weeks	8 weeks	10 weeks
T <sub>1</sub>	20 <sup>b</sup>	45 <sup>b</sup>	74 <sup>a</sup>	92 <sup>a</sup>	108 <sup>a</sup>
T <sub>2</sub>	14 <sup>c</sup>	39 <sup>c</sup>	64 <sup>b</sup>	86 <sup>a</sup>	104 <sup>a</sup>
T <sub>3</sub>	27 <sup>a</sup>	51 <sup>a</sup>	76 <sup>a</sup>	86 <sup>a</sup>	87 <sup>b</sup>
T <sub>4</sub>	19 <sup>b</sup>	42 <sup>c</sup>	63 <sup>b</sup>	88 <sup>a</sup>	106 <sup>a</sup>
C.V (α=0.05)	7.388	5.172	6.438	8.106	5.294

In 2 weeks and 4 weeks after planting, plant height of T<sub>3</sub> treatment (broadcasting) was significantly higher than T<sub>1</sub>, T<sub>2</sub> and T<sub>4</sub> treatments. T<sub>3</sub> might give the highest plant height because it had no transplanting shock. T<sub>2</sub> (Dapog) gave the lowest height during first month compared to the height of T<sub>1</sub> (SRI) and T<sub>3</sub>. T<sub>4</sub> (twisted straw rope method) showed similar results as T<sub>2</sub>. These plants would have nitrogen deficiency in the first 2 weeks of transplanting as straw had started to decompose, and where microbial growth was high. At the 8<sup>th</sup> week, plant heights were not significantly different among treatments; proving that all plants gradually recovered from transplanting shock and nitrogen also has become no more deficient. In the 10<sup>th</sup> week, the opposite results were observed i.e. T<sub>3</sub> has given the lowest height while other three treatments gave significantly higher plant heights. In T<sub>3</sub> plant density was high compared with others and this high density would have developed a competition effect among plants resulting lower plant height. Number of leaves and number of tillers showed a similar patterns.

Table 02: Effect of Rice Plant Establishment Methods on Shoot dry weight, Number of panicles/plant and Yield. (t/ha)

Treatments	Shoot dry weight (g)	Number of Panicles/plant	Yield (t/ha)
T <sub>1</sub>	37.96 <sup>a</sup>	24 <sup>a</sup>	2.46
T <sub>2</sub>	22.12 <sup>b</sup>	11 <sup>c</sup>	1.97
T <sub>3</sub>	12.86 <sup>c</sup>	7 <sup>d</sup>	2.45
T <sub>4</sub>	37.27 <sup>a</sup>	17 <sup>b</sup>	2.24
C.V (α=0.05)	7.5	5.6	9.9
LSD			0.3

Shoot dry weight of plants of SRI method (37.9g) was not significantly different from the shoot dry weight of plants of twisted straw rope method. The lowest shoot dry weight was observed in the T<sub>3</sub> treatment (broadcasting) (Table 02). Number of panicles, was significantly different among four treatments. The lowest number of panicles/plant was recorded in T<sub>3</sub> treatment (broadcasting method). SRI method had the highest panicle number (24/plant) comparing that of other treatments, the second highest value (17) was observed in T<sub>4</sub> (twisted straw rope method) (Table 02).

The yield of dapog planting method was significantly different from yield of SRI method as well as broadcasting. The lowest yield was observed in T<sub>2</sub> treatment. T<sub>4</sub> (twisted straw ropes method) gave comparatively higher yield than dapog planting method (Table 02).

**Experiment 02: Effect of size of straw rope on performances of rice crop**

Table 03: Number of Leaves at 2, 4, 6, 8 and 10 weeks after Planting

Treatment	Number of leaves			
	4 weeks	6 weeks	8 weeks	10 weeks
T <sub>1</sub> (5cm)	10 <sup>a</sup>	34 <sup>a</sup>	62 <sup>a</sup>	80 <sup>a</sup>
T <sub>2</sub> (7.5cm)	10 <sup>a</sup>	30 <sup>a</sup>	60 <sup>a</sup>	80 <sup>a</sup>
T <sub>3</sub> (10cm)	10 <sup>a</sup>	26 <sup>a</sup>	54 <sup>a</sup>	88 <sup>a</sup>
C.V(α=0.05)	2.6	9.6	8.3	8.7

There was no significant difference in number of leaves among T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> treatments from 2 to 10 weeks. But in early stages of the establishment, the lowest number of leaves was showed in the T<sub>3</sub> treatment (10cm diameter of straw ropes). As T<sub>3</sub> treatment had more straw than other two treatments, the

microbial activity in the early stages might be higher in T<sub>3</sub> treatment and it resulted nitrogen deficiency in the soil than other treatments. But after the decomposition of straw at later stages (10 week) T<sub>3</sub> treatment gave a higher leaf number due to correcting the nitrogen deficiency.

Table 04: Number of Panicles/plant, Filled Grain %, 1000 Seed Weight

Treatments	Number of Panicles/plant	Filled grain %	1000 seed weight (g)
T <sub>1</sub>	16 <sup>a</sup>	83.76 <sup>a</sup>	22.04 <sup>a</sup>
T <sub>2</sub>	17 <sup>a</sup>	84.41 <sup>a</sup>	21.46 <sup>a</sup>
T <sub>3</sub>	16 <sup>a</sup>	85.04 <sup>a</sup>	22.06 <sup>a</sup>
C.V (α=0.05)	4.3	1.3	4.6

Panicle number showed, that there was no significant difference between T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> treatments. The highest number of panicles was recorded in T<sub>3</sub> (10cm diameter) than other two treatments (Table 04).

Filled grain % and 1000 seed weight were also not significantly different among three treatments (Table 04).

### Experiment 03: Effect of application of urea solution for twisted straw ropes

Table 05: Plant Height up to 6 weeks, Number of tillers/plant 4 and 6 weeks after Planting, Shoot dry weight at 6 weeks after Planting

Parameters	Treatments	Time		
		2 weeks	4 weeks	6 weeks
Plant height (cm)	T <sub>1</sub>	33 <sup>a</sup>	62 <sup>a</sup>	84 <sup>a</sup>
	T <sub>2</sub>	30 <sup>a</sup>	46 <sup>b</sup>	64 <sup>b</sup>
C.V (α=0.05)		3.0	4.1	5.6
Number of tillers/plant	T <sub>1</sub>		3 <sup>a</sup>	11 <sup>a</sup>
	T <sub>2</sub>		3 <sup>a</sup>	10 <sup>a</sup>
C.V (α=0.05)			8.1	8.2
Shoot dry weight (g)	T <sub>1</sub>			5.04 <sup>a</sup>
	T <sub>2</sub>			3.50 <sup>b</sup>
C.V (α=0.05)				4.2

Two weeks after planting, there was no significant difference in plant height between T<sub>1</sub> (urea treatment) and T<sub>2</sub> (without urea treatment). After 4 weeks and 6 weeks, plant height of urea treated straw ropes was significantly different from that of non urea treated straw ropes. The highest plant height was observed in T<sub>1</sub> at the 4<sup>th</sup> and 6<sup>th</sup> weeks after planting. Non-urea treated plants would suffer from N deficiency. In T<sub>1</sub> (treated with urea) microbial density may be high and straw decomposition would have occurred done quicker than in T<sub>2</sub> (without urea). So there was no nitrogen deficiency in T<sub>1</sub> treatment. This reason would cause higher plant height after two weeks of planting in T<sub>1</sub> treatment than T<sub>2</sub> treatment (Table 05). There was no significant difference in number of tillers between urea treated straw ropes and no urea treated straw ropes (Table 05). Shoot dry weight of T<sub>1</sub> (urea treatment) differed significantly from that of plants without urea treatment straw ropes. The highest shoot dry weight was given by the urea treated straw ropes (Table 05).

### Soil chemical properties (pH and EC) up to 9 weeks after planting

pH and EC values were not significantly different among treatments. But 9 weeks after planting pH in twisted straw rope method was somewhat higher than the others. When straw was decomposed, pH values increased and gradually reached to 7.

### Conclusion

Twisted straw rope method was an effective planting method for lowland rice. Straw ropes with a diameter of 10cm ropes were better than the ropes of 5cm and 7.5cm diameters. Application of urea solution for twisted straw ropes before placing in the field has shown a beneficial effect on the growth of rice seedlings compared to that of rice seedlings grown on non urea treated ropes.

### References

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