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Trials on varietal adaptability to direct seeding method in two levels of deep water

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Abstract. Four (4) rice varieties Chirnogi, Cristal, Oltenita and Speranta, all Japonica, nonglutinous, were used for green house experiment to study the varietal adaptability, to direct seeding method in two levels deep water trial. Significant difference in the number of panicles/mp, number of spikelets/panicle, 1000-grain weight and yield were observed among the varieties and also between treatments.
Oltenita variety at 5/5 cm deep water levels was found to give the best results.

Introduction

Rice is not the staple food crop in Rumania, but its cultivation is necessary to avoid import and to utilize the over 300,000 ha of salinity area, which is improper to other crops.

New varieties with good emergence ability in the submerged condition are necessary to solve the problems that are caused by the lack of good levelling in large fields.

Regarding with those problems, a variety, a deep water layer, plots levelling and a fertilizer, especially nitrogen, consist the key elements in rice production. Nitrogen absorbed by the plant from tillering stage to panicle initiation stage increases the number of tillers and panicles. Also, nitrogen absorbed during the panicle development increases the number of spikelets per panicle, percentage of ripened grains and 1000-grain weight (Matsushima, 1969, De Datta, 1978). In addition, top-dressing of nitrogen at 5-7 days before the panicle initiation is absorbed and taken more by Ahmed results (1990).

Concerned on the nitrogen usage with efficiency and varietal adaptability in direct seeding method, the following objectives were derived from the title:

- to study difference on a growth, lodging degree and yield components among 4 varieties, in 2 levels of water depth,
- to find more effective application method in order to get high yield.

I – Materials and Methods

The experiments were conducted in the green house and field of the Rice Experimental Centre, Chirnogi, from April to October 1999. The experiment used alluvial soil, with pH of 8.0.

Randomized Complete Block (RCB) design was used such:

A. Green House Experiment

- 4 varieties: Chirnogi, Cristal, Oltenita and Speranta
- 4 treatments of water levels:
  - W1 - 5/5 cm, 5 cm in all growth periods.
  - W2 - 5/10 cm, 5 cm in germination stage and 5 cm in other growth periods.
  - W4 - 10/10 cm, 10 cm in all growth periods.
- 2 replications. (4. 4. 2. type)
- Density 264 germinated seeds/mp.
- Fertilizer 100 g/mp (6-9-6 type), basal application.

- Cell size 1.0 mp.

The seeds were disinfected by Helthied fungicide. The seeds were soaked in cold water (18-19°C) during three days, then the water temperature was raised to 32°C for sprouting.

The sowing was done at end of April (04.27.93), by using 80 Kg/ha of germinated seeds (No. of germinated seeds 260/sq. m).

Weeds and pest control: One day after sowing, SUN- BIRD herbicide was applied, 30 kg/ha. After 7 days the second treatment application (A), included P & K, was done before sowing.

Top-dressing of ammonium sulfate as a source of N was applied according to the treatments planned.

II – Data gathering

- during the germination stage, the water and air temperature were recorded.
- after germination, number of plants established/sq. m and tillering stage, 3 samples from each treatment and repetition were recorded, in term of plant and tillers number .
- for the investigation of yield components, 1/3 sq. m sample, from each treatment and repetition were taken in October 1 st 99. The harvesting time, in green house, was Sept. 18 for all 4 varieties. The grain yield and 1000 grain weight, were calculated in the form of paddy rice, at 14.5% moisture contents. Statistical analysis on the data, were done according to "F" test.

III – Results and discussions

The most important things in direct seeding of rice are to raise the stability of the emergence and establishment rate of seedlings. The results showed that the percentage of seedlings established was over 80% in all varieties. The difference between treatments and varieties was not significant (Fig. A 1). As is showed in Table A 1, in 3 leaf stage, the difference of plant height between 5 cm and 10 cm deep water was significant in 1% level among the varieties and significant in 5% level between treatments. It indicates that in case of 10 cm deep water, after the germination of seed, the young plants tend to elongate for reaching at the water surface. It looks like flooded plants.

The number of tiller/sq. m. was increasing till 30-35 days after sowing, until the number of tillers was sharply decreased and stabilized at 70-80 days after sowing, and then remained the number till harvesting.

At 35 days after sowing, the difference on the number of panicles/sq.m. between 5 cm and 10 cm treatment was significant in 1% level (Table A 1). In the 5 cm treatment, the tillering ability was higher than that in 10 cm, the lower internode couldn't produce the same number of tillers in 10 cm than 5 cm deep water. Finally, the number of panicles/sq. m, didn't vary so much between the two water depths, but varieties Chirnogi and Cristal tended to decrease the number of panicles/sq. m. The big decreasing in the number of panicles seems to be due to the soil fertility used in the plots. The amount of chemical fertilizer used was very small.

According to Table A 2, A3 & Fig. A1, there was difference of plant density between all 4 varities, and also between 5 and 10 cm.

Five (5) cm showed higher planting density than in 10 cm . Chirnogi and Cristal showed a higher plant density (387, 395). This phenomenon could be due to the length of vegetative growth period. The vegetative growth period of Chirnogi and Cristal are shorter than that of Oltenita and Speranta. Number of panicles/sq. m. of them were 330.5 and 319.5, respectively.

The number of spikelets per panicle (Table 1, 2, A3 & Fig A1), showed higher significant difference among varieties and insignificant on water depth. It is due to Oltenita which showed very uniform data among all the treatments (with the mean was 67. 14). Chirnogi tended to rise while Cristal tended to decrease in 10/10 cm treatments. The reasons could be that Cristal is present in a higher density/sq. m. Because there was a negative correlation between No. of panicles and No. of spikelets/panicle. The highest number of spikelets/panicle was showed by Oltenita (68.39), followed by Speranta(52.88). Among water levels, the higher value of the spikelets/panicle present 5/10 cm treatment (57.5) and 5/5 cm (57.3). The lower value is in 10/10 cm treatment (52.6).

Table 2 (comparison between 5 & 10 cm level, after germination) shows a significant difference between varieties (from the lowest value 45.73 in Chirnogi, and the highest value 64.88 in Oltenita). Between 5 & 10 cm treatments the values varied from 56.8 in 5 cm (W1, W3), to 53.9 in 10 cm (W2, W 4) treatment.

The percentage of ripened grains (Table 1, 2, A3 & Fig. A1), showed a significant difference among varieties, but insignificant in treatments. As is shown in Fig. A1, the behaviour of varieties was completely different. And they can be clearly separated into two groups. One group, Chirnogi and Cristal, with lower percentage of ripening grains (especially Cristal, which presented very significant decreasing in 5/10 cm treatment, but a higher increase in 10/10 cm treatment). The second group is Oltenita and Speranta(with the higher percentage, insignificant difference among the treatments). This phenomenon could be due to the different vegetative growth period.

Chirnogi and Cristal were affected by the climatic condition, the very low sunshine amount recorded through the vegetative growth period. Between water levels, no significant difference were observed, also in comparison between 5 & 10 cm (Table 2, Fig. A2), no significant difference was observed among varieties. The percentage was the lowest, 54.11%, in Chirnogi, followed by Cristal, with 49.57%. And the highest in Oltenita with 56.37%.

Thousand (1000) - grain weight (Table 1, 2, A3 & Fig. A2) showed a significant difference in 1% level, among varieties.

Genetically the grain size was decided on each variety with slight difference. However, Oltenita and Speranta tended to be heavy in 10 cm 10/10 cm treatment. It showed a significant difference between treatments and varieties.

Yield per panicle (Table A 1, 2, A3 & Fig. A 2) showed significant difference in 1% level among varieties and treatments. Difference between replications could be due to the arrangement of replication No. 2. It has been fixed in the edge of the green house where the light intensity was less than replication No. 1 .

The yield was 0.99 g in Cristal, 1.08 g in Chirnogi, 1.65 g in Oltenita and 1.28 in Speranta .
Among the treatments, 5 cm seems to be also better than 10 cm, among all varieties. The values varied from 1.32, 1.27 g, in 5/5, 10/5 cm (W1,W3), to 1.29, 1.20 g in 5/10 & 10/10 cm (W2, W4) deep water treatments. Also, according to Table 2 and Fig. A2, between 5 & 10cm deep water after germination stage showed a significant difference between varieties (Chirnogi and Cristal with lowest yield/panicle of 0.993 g & 1.083 g and Oltenita, with 1.65 g/panicle). Among the treatments, the values were between 1.27 g in 5 cm (W1, W3), to 1.2 g in 10 cm (W2, W4).

Yield per sq.m. (Table 1, 2, A3 & Fig. A2), showed significant difference in 5% level among varieties (393.0 g in Cristal and 409.4 g in Speranta and the highest value, 523.5.0 g, in Oltenita). Among the treatments also it showed difference between 5 cm (W1, W3) with 510.45 g and 10 cm (W2, W4) with 371.379 g/sq.m.

Also the comparison made between 5 cm (W1, W3) and 10 cm (W2, W4) deep water after germination stage (Table 2; Fig. A2), it showed significant in 5% level, among varieties (lowest value 393.3 g in Cristal, followed by Speranta with 409.5 g and highest value 523.5 g in Oltenita).Between treatments it showed difference between 5 cm (W1, W3), with 487 g and cm (W2, W4), with 375 g/sq. m.

Conclusions

From the results, the water management, especially water level is an important factor in receiving good density in rice crop. Five (5) cm level in all vegetative growth period gave the best results. The 10 cm deep water level seems to be the function as the regulator of tillers growing, and the negatively influenced on the plant density. Also, after germination of seeds, in 10 cm deep water, plant length at 2-3 leaf stage showed elongation to the water surface. In Romania, these elongated seedlings are caused by the flood and they induce serious pest damage (Chironomideae spp.).

Five (5) cm deep water level received a very good seedling establishment. It was directly depended on the quality of levelling of the plots. Also the elongation of the lowest internodes was less than 10 cm with the effect of lodging resistance. According to researchers, in direct seeding method, the selection of variety is important factor. The variety needs good adaptability to direct seeding, high ability of emergence and establishment of seedling, a short culm, deep and large roots and a resistance to lodging. Regarding to these standard Oltenita and Speranta seems to be good among 4.

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TABLES

Table 1. F values

Yield components, internodes elongation and three leaves plant high in varietal adaptability to direct seeding method in two level deep water trials.

Treatment	No. of panicles	No. of spikelet	% ripened grain	1000 weight (g)	Yield/panicle (g)	Yield/sq/m (g)	Internodes length 3/4 (cm)	4/5 (cm)	3 leaves pl length (cm)
Chirnogi	387.0	50.23	52.45	24.68	1.08	426.4	16.1	5.0	23.45
Cristal	395.0	51.11	54.32	23.03	0.99	393.0	15.28	1.4	25.74
Oltenita	330.5	68.39	69.35	25.05	1.65	495.0	10.59	2.09	27.25
Speranta	319.5	52.88	68.29	27.10	1.28	409.4	10.60	3.24	22.76
	358.1	55.65	61.09	25.16	1.25	437.9	13.14	2.93	24.05
F Variety	*	**	**	**	**	*	**	**	**
	3.578	25.68	30.64	156.3	97.39	5.10	54.74	17.71	8.23
5/5 cm	400.0	57.30	61.10	25.03	1.32	510.0	13.40	3.3	22.3
5/10 cm	327.0	55.30	60.20	25.10	1.21	371.0	13.70	3.4	25.6
10/5 cm	384.0	57.50	61.00	25.20	1.27	450.0	13.80	3.0	22.6
10/10 cm	323.0	52.60	62.10	25.10	1.20	379.0	11.70	2.1	25.8
F water	ns	ns	ns	ns	**	ns	*	*	**
	1.678	2.197	1.50	0.12	16.25	2.90	4.518	5.085	9.46
Variety x			ns	ns			ns	ns	ns
Water			1.50	5.223			0.286	1.436	0.39

** = significant in 1% level
* = significant in 5% level
ns = no significant

Table 2. F values

Yield components and differences between 5-10/5 cm (w3) and 5-10 /10 cm (w2, w4) treatments

Treatment	No. of panicles	No. of spikelet	% ripened grain	1000 weight (g)	Yield/panicle (g)	Yield/sq/m (g)	Internodes length 3/4 (cm)	4/5 (cm)	3 leaves pl length (cm)
Chirnogi	387.5	45.73	46.41	24.70	1.083	426.8	16.13	4.78	23.55
Cristal	395.0	51.10	49.57	22.75	0.993	393.3	15.30	1.15	25.60
Oltenita	330.5	64.88	56.37	26.55	1.648	523.5	10.63	2.18	24.80
Speranta	319.5	52.88	55.78	27.15	1.280	409.5	10.63	2.88	21.40
Mean	358.1	53.53	52.02	25.33	1.251	438.3	13.17	2.74	23.78
F Variety	*	**	**	**	**	*	**	*	**
	7.542	14.61	12.48	10.50	56.03	7.19	150.57	5.84	35.2
5-10/5cm	392	53.9	52.6	25.3	1.27	487	13.6	2.7	22.5
5-10/10cm	325	53.9	52.6	25.3	1.20	375	12.7	2.8	24.9
F water	ns	ns	ns	ns	ns	ns	ns	ns	ns
	136.2	11.5	2.88	0.0	20.5	21.86	0.59	0.184	47.1

** = significant in 1% level
* = significant in 5% level
ns = no significant

Table 3. F values
Yield components and differences between 5/5-10 cm (w1-w2) and 10/5-10 cm (w3, w4) treatments

Treatment	No. of panicles	No. of spikelet	% ripened grain	1000 weight (g)	Yield/panicle (g)	Yield/sq/m (g)	Internodes length 3/4 (cm)	4/5 (cm)	3 leaves pl length (cm)
Kitaake	387.5	50.25	46.41	24.7	1.083	426.8	16.13	5.03	23.48
Hayamasari	395.0	51.13	47.49	23.1	0.993	393.3	11.93	1.40	25.78
Kinuhikari	330.5	68.43	56.37	25.9	1.648	523.5	11.50	2.10	24.28
Hatsuboshi	319.5	52.88	55.72	27.1	1.280	434. 5	10.93	3.28	22.0
Mean	358.1	55.67	51.50	25.2	1.251	444.5	12.62	2.95	23.88
F water	**	**	**	**	**	*	ns	**	*
	12.06	27.78	17.01	38.9	55.08	5.73	1.18	9.83	7.17
5/5-10 cm	363	56.3	51.3	25.2	1.27	448	13.7	3.4	23.9
10/5-10cm	353	54.4	51.7	25.1	1.24	414	11.5	2.5	23.8
F water	ns	ns	ns	ns	ns	ns	ns	ns	ns
	2.88	0.75	0.74	1.78	2.16	0.61	1.52	3.2	0.3

** = significant in 1% level
* = significant in 5% level
ns = no significant

Fig. A Layout of the Experimental Plots

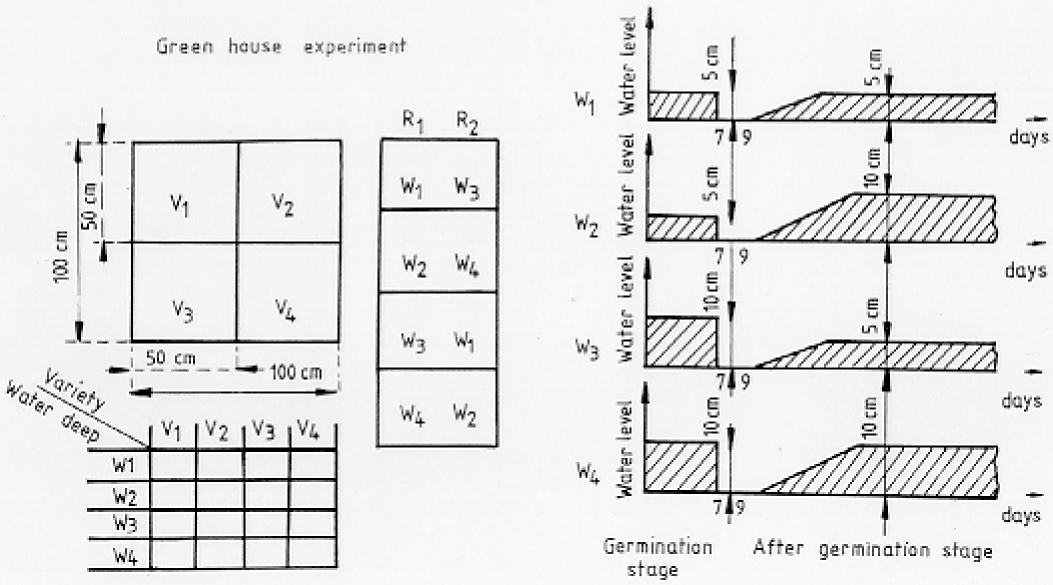

Fig. A, Seedling & Growth curves of tillering in different treatments

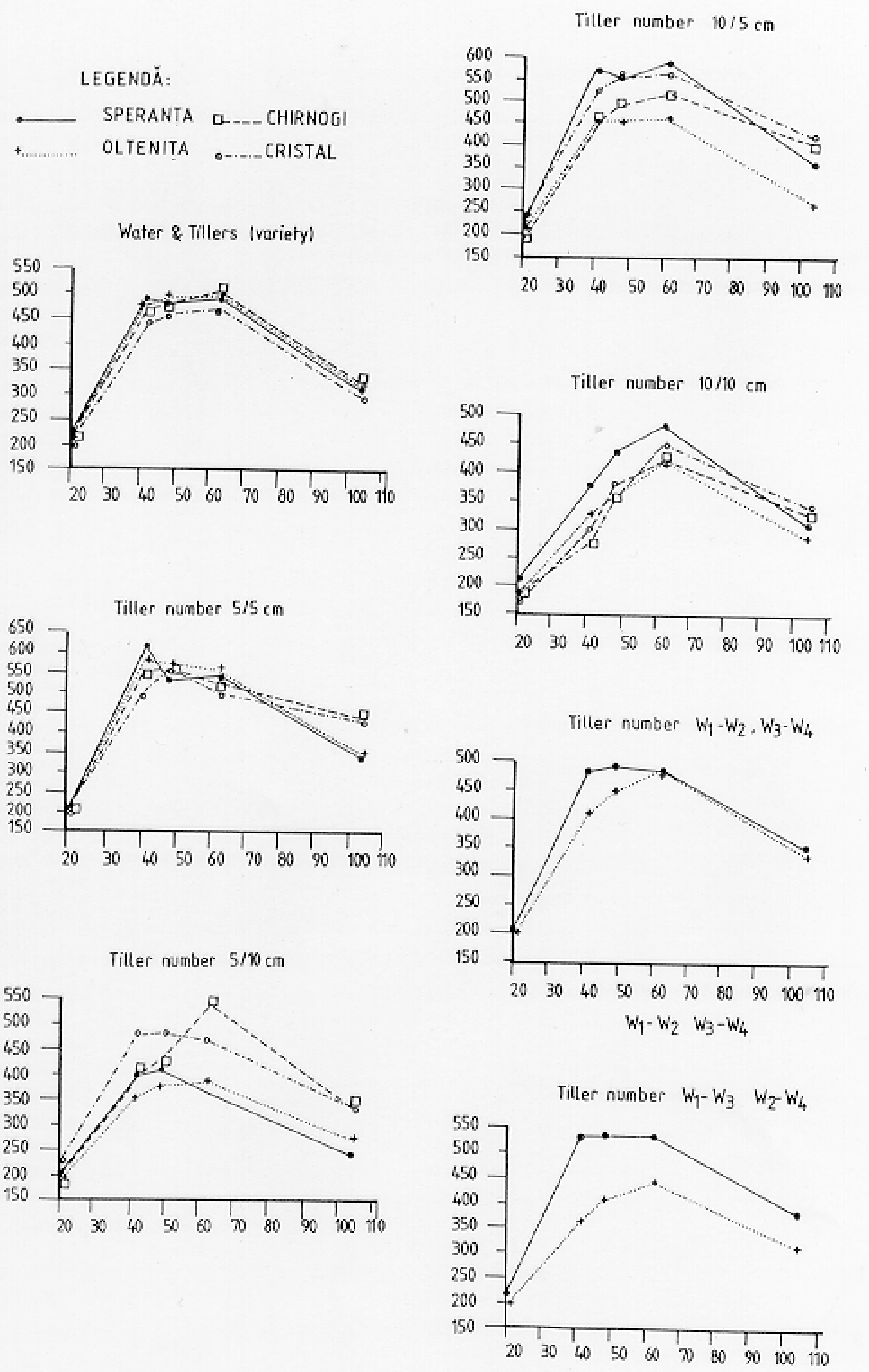

Fig. A₂ The yield components curves