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YIELD AND SEED QUALITY STUDIES OF DRY SEEDED RICE ADT 36 IN RELATION TO IRRIGATION REGIMES

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ABSTRACT

Dry seeding and continuous submergence thereafter produced more number of tillers and seeds. The quality of the resulting seed was not affected by dry seedling. The vigour and viability of the seeds from treatments, continuous submergence (I_3) and irrigation three days after disappearance of ponded water to 5 cm (I_2) or submergence to saturation (I_1) were similar on fresh and aged seeds.

The cultivated species of rice is generally considered as hydrophytic but under higher water scarcity, the need for dry seeding and upland cultivation, now grown over 21.19% of total rice area in India, is increasing, where the upland ecotypes may be comparable to other cereals, which are capable of growth and yield, upon return to a flooded soil habitat. Studies were initiated to evaluate the influence of different irrigation regimes on yield and quality of the resulting seeds under dry seeded conditions in rice.

MATERIALS AND METHODS

Dry seeds of rice (Oryza sativa L.) cv ADT 36 were sown in lines 15 cm apart in a well pulverised soil, covered and irrigated immediately. The field was kept under gardenland condition, irrigating one in 6 days, unitl 35 days after sowing. Afterwards, the irrigation treatments were imposed as in Table 1. The experiment was conducted in a randomised block design. The crop was fertilized with 0:50:50 kg NPK/ha as basal and 100 kg N/ha was top dressed in 4 equal spilts at 20, 35, 60 and 80 days after sowing. Zinc sulphate @ 25 kg was applied at 20 days after sowing. The quantity of applied water was maximum in irrigation regime I_3 (1503 mm) followed I_2 (1083.4 mm) and I_1 (1000.2 mm). Other package of practices were those adopted for a conventional rice crop. Irrigation was withheld 10 days before harvest.

At harvest, the number of tillers was counted over an area of 0.25 m^2. Ten panicles were selected at random for counting the number of filled grains per panicle. The produce was dried to a uniform moisture content of 10 ± 0.5%, cleaned and graded using 1/14" x 3/4" oblong sieve for calculating the recovery percentage of seeds. Seed weight was recorded from the graded seeds and expressed in gram. Initial seed quality

Table 1. Details of the irrigation treatments imposed

Treatments		Quantity of water applied (mm) during different crop periods (days)		
		0-35	36-105	Total
I_1	Submergence to saturation (irrigating to a thin film of water after hairline cracks appear)	275.5	724.7	1000.2
I_2	Irrigation to 5 cm, three days after disappearance of ponded water	275.5	807.9	1083.4
I_3	Continuous submergence to 5 cm	275.5	1227.5	1503.0

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analyses on germination, root length, shoot length, dry matter production, vigour index and electrical conductivity were assessed from 3 months old seeds stored under ambient condition (mean temp. 27 ± 0.4 °C and R.H. 74 ± 0.5%). Part of the sample from various treatments was artificially aged at 40 ± 1°C and 98 ± 2% R.H. for 20 days and analysed for the parameters mentioned elsewhere. The germination test was conducted on a 4 x 100 seeds according to ISTA rules (Anon, 1985). The root and shoot length were measured from all the normal seedlings and the mean expressed in cm. The seedlings were dried at 85°C for 24 h for dry matter estimation and the mean expressed in mg. The vigour index was calculated after Addul-Baki and Anderson (1973). Electrical conductivity of the seed leachate was measured by soaking 25 seeds in 25 ml of distilled water for 6 h and expressed as µmhos/cm (Presley, 1958).

RESULTS AND DISCUSSION

The results are presented in Table 2. Continuous submergence to 5 cm recorded the maximum number of productive tillers/m^2 359). I_1 was equally better, producing 328 productive tillers/m^2. I_2 produced only 284 productive tillers/m^2. The same trend was noticed for the number of filled grains/panicle. Irrigation treatments did not influence the recovery percentage and 1000 seed weight.

Initial evaluation of seedlings from seeds obtained by I_2 and I_3 recorded non-significant differences in germination (92, 95, and 93%), root length (19.3, 18.9 and 19.2 cm), shoot length (9.4, 9.1 and 9.4 cm), dry matter production (13.1, 12.8 and 13.0 mg) and vigour index (2646, 2660 and 2650) respectively. The electrical conductivity of the seed leachate from various irrigation regimes showed minor variations.

Under accelerated ageing test also, the differences among various viability and vigour parameters for different irrigation treatments were not significant. However, the rate of reduction with regard to germination (10.86%), dry matter production (6.10%) and vigour index (17.68%) and the rate of increase with respect to electrical conductivity (42.59%) was less in seeds obtained from treatment of continuous submergence to 5 cm. Seeds from I_1 closely followed the seeds from I_3 with 11.82%, 6.92% and 17.28% reduction in germination, dry matter production and vigour index and 46.15% increase in electrical conductivity. In I_2 the seeds showed higher rate of reduction for germination (12.63%), dry matter production (7.81%) and vigour index (17.89%) and increase in electrical conductivity (53.85%). The rate of reduction in root and shoot length did not differ much among various irrigation treatments.

The response of rice crop to water deficit has most often been reported in terms of reduced plant height, number of tillers, leaf area and dry weight of shoots and roots and yield (IRRI, 1986). Continuous submergence induced earliness in flowering (Saha **et al.**, 1974), increased the number of productive tillers (Panda **et al.**, 1980) and yield (agarwal **et al.**, 1985) than intermittent submergence (Mohankumar and Singh, 1984) and saturated condition (Das and Mandal, 1986). According to Mohandass **et al.** (1988), the number of productive tillers, number of grains and grain yield were not affected when irrigated either by continuous submergence or submergence to saturation. The decrease in tiller number at reduced water availability is likely to be compensated by the growth of additional tillers during the extended vegetative phase, when rewatered. This cannot be always true as in the present instance, where reduced number of productive tillers was observed

Table 1. Yield and seed quality parameters as influenced by irrigation in dry seeded rice cv ADT 36.

Treatment	Number of productive tillers/m^2	Number of filled seeds/panicles	Recovery percentage of seeds	1000 seed weight (g)	Available water use efficiency kg/ha-mm	Initial Evaluation						After accelerated ageing*					
						Germination (%)	Root length (cm)	Shoot length (cm)	Dry matter production (mg)	Vigour index	Electrical conductity/u mhos/cm	Germination (%)	Root length (cm)	Shoot length (cm)	Dry matter production (mg)	Vigour index	Electrical conductivity/u mhos/cm
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18
L_1	328	61	89.4	22.59	3.50	93 (75.11)	19.2	9.4	13.0	2650	52	82 (65.12)	18.3	8.5	12.1	2192	76
L_2	284	57	90.1	22.63	3.07	95 (77.34)	18.9	9.1	12.8	2660	52	83 (65.96)	18.0	8.2	11.8	2184	80
L_3	359	64	90.3	22.73	2.65	92 (74.11)	19.3	9.4	13.1	2646	54	82 (64.93)	18.1	8.4	12.3	2178	77
C.D.	28.33*	3.59**	N.S.	N.S.	0.08**	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

(Figures in parentheses represent aresine transformation)

I : Submergence at saturation

I : Irrigation to 5 pm three days after disappearance of ponded water

I : Continuous submergence to 5 cm

XS. : Not Significant

* : Aged for 20 days at 40 ± 1°C and 98 ± 2% R.H

**: Significant at 1% level

in the treatment irrigation to 5 cm three days after the disappearance of ponded water. The developmental processes such as panicle initiation, gametogenesis, anthesis and fertilization may be disrupted resulting in reduced spikelet and seed filling. Similar changes would have taken place in treatment I_2 which resulted in the minimum number of filled grains/panicle, eventhough the quantum of applied irrigation was more than that of submergence to saturation, The non-synchronous character of paddy, where the completion of flowering of a single panicle takes about 7 days and the flowering in a field may continue for more than 15 days, the probability of large yield losses associated with a severe water deficit would have been compensated through more number of seeds with good filling in the treatment I_1 but not so in treatment I_2. This may possibly be due to the higher uptake of Zn and its subsequent translocation to the grain/seed and straw during submergence to saturation (Neue and Mamaril, 1985). Zinc acts as an additive factor in growth and developmental activity. The level of available Zn and Mn may be optimum when irrigated at the hairline crack development which permits easy gaseous exchange, favours root browing and aids in more nutrient absorption. The reduction in number of tillers and grains in treatment I_2 may be due to the excess availability of Zn which prevents the uptake of Fe. Though present in a reduced state, Zn and Mn may not be available to the growing rice plants, because of the competition in the root exchange sites by Fe.

When aged artificially the seeds from three different irrigation treatments, behaved alike showing a general decline in vigour and viability. The differences in the rate of reduction in seed quality characters, among various irrigation treatments, could not be attributed to treatment differences owing to their non-significance for statistical scrutiny. Since the yield loss is higher in treatment, I_2, it may not be economical to use seeds from such treatment.

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COST-BENEFIT ANALYSIS OF MAJOR OILSEED CROPS OF SAURASHTRA (GUJARAT)

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ABSTRACT

Annual growth rates in production and productivity of the crops were found positively significant however, the rate of increase in the yield of groundnut was relatively less. Higher variability in area, production and yield was observed in case of castor crops. Human labour, bullock labour, manures and chemical fertilizers were the main items of operating cost in all the crops, moreover, seed played important role in the total cost of groundnut cultivation and irrigation charges had greater effect on the cost of cultivation of castor crop. Castor crop was found more remunerative to growers as compared to other oilseed crops under study.

The need for increased oilseeds production in India is well recognised. Indian farmers have been growing a variety of oilseeds and the major ones are groundnut, castor, sesamum, rape and mustard. Much of the instability in production of oilseeds is derived from the predominantly rainfed nature. Expansion of oilseeds in these areas would thus not only pave the way for optimum utilisation of water but also help import substitution. So, it is now time to assess the magnitude of major oilseeds crops and to work out its cost-price structure which will be useful to the policy makers as well as researchers.

MATERIALS AND METHODS

The secondary data related to area, production and yield of groundnut, sesamum and castor for all the six districts of Saurashtra were obtained from the Directorate of Agriculture, Gujarat State, Ahmedabad for the period from 1960-61 to 1986-87. The annual compound growth rates (r) in relation to area, production and yield per hectare were computed by the exponential formula. Co-efficients of variation (CV%) of

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