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Effect of Different Moisture Regimes on Yield and Yield Components of Fine Rice (*Oryza sativa* L.)

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Abstract
This study was undertaken to determine the effect of four moisture regimes i.e. I_1 (77.5), I_2 (100), I_3 (122.5) and I_4 (145 cm during 1992 and 1993. The study revealed that each additional level of moisture regime increased plant height, grain yield and yield components significantly. Number of panicle bearing tillers hill $^{-1}$, and number of spikelet panicle $^{-1}$ were significantly higher in I_4 (145 cm). Significantly higher grain yield were produced by I_4 (145 cm). Effect of irrigation was most pronounced on the yield components which developed fully at optimum irrigation level (I_4). Consequently, their contribution to grain yield was substantially increased.

Introduction
Rice crop in Pakistan is grown on an area of 2251 thousand hectares with annual production of 4305 thousand tones, giving an average rice yields of 1912 kg ha $^{-1}$ (Anonymous, 1997). This average yield is very discouraging since, there is a big gap between the actual and potential per unit area yield of the crop. Among cereals rice has the lowest productivity per unit of water. The main season for growing rice is rainy season and irrigation is provided only during deficit period to make up the water requirements. Rice crop grower in dry season or in low rainfall areas consumes large amount of water with very low water use efficiency. The amount of water added to rice crop under most irrigation systems is very high (2500 mm as against 480 mm of evapotranspiration). Experimental results have shown that low land rice gave maximum yield under submerged soil condition (Sahu and Raut, 1969).

Biswas and Bhattacharya (1987) concluded that increase in water depth decreased in number of tillers hill^{-1} and increased plant height. The 1000-grain weight was higher in submerged than in rainfed crops.

Dabral and Rao (1992) analyzed data from a field experiment on farmers field in rice CV-Ratna. Results indicated that maximum grain yield 5.37 t/ha was obtained with irrigation regime of 166.05 cm.

Differences are also reported to occur by supplying different amounts of water at different growth stages. Tillering, primordia initiation and flowering are most critical stages of development and any sort of stress in moisture supply at these stages reduces the grain yield appreciably. Work done in Nadia district in Aus (Autumn rice) indicated that a brief stress in the application of water affects crop and growth adversely at the flowering stages in decreasing sequences (I) flowering (ii) grain filling, (iii) tillering, (iv) pre-tillering stages. (Annual Progress report of work done in the water management scheme of the Govt. of W. Bengal, 1973-74). The objectives of the study are to see the effect of different levels of moisture regimes on yield and yield components of fine rice cultivar KSK-385 under irrigated conditions of Faisalabad. It can therefore safely be recommended that fine rice variety (KSK-385) should preferably be irrigated at 145 cm moisture regime (19 irrigations) when grown on sandy clay loam soil to realize maximum grain yield under in agro-ecological conditions obtained at Faisalabad.

Materials and Methods
Basmati-385 was sown at Postgraduate Agricultur Research Station, University of Agriculture, Faisalaba during 1992 and 1993. The nursery was sown adopting dr sowing method in the Ist weak of June. One month ol seedlings were transplanted in the first week of July.

The experiment was carried out in field and laid out in spl plot design with 3 replication maintaining a net plot size o 3 x 4 m^2. Four irrigation levels/moisture regimes, 1 irrigation (77.5 cm), 13 irrigation (100 cm), 16 irrigatio (122.5 cm) and 19 irrigation (145 cm) were maintaine accordingly till maturity to meet the water requirements the crop plants and to suppress weed growth. Supply irrigation water was stopped one weak before harvestin when signs of maturity appeared.

Before harvesting plant height of randomly selected 2 plants were recorded. The number of panicle bearing till hill $^{-1}$, number of spikelets panicle $^{-1}$ and 1000-grain weig were recorded. Grain yield and straw yield were record harvest index was computed as the ratio of grain yield straw yield. The data collected were statistically analy by applying Fisher's analysis of variance techniq Treatment means were compared by Duncan's new multi range test at 5 per cent level of probability to determ statistical differences (Steel and Torrie, 1980).

Results and Discussion
Plant height: In case of moisture regimes, maximum pl height (136.98 cm) was recorded in I_4 (145.42 cm) wh was followed by 132.59 cm, 128.03 cm and 124.07 cn I_3, I_2 and I_1 in a descending order. The more plant he obtained in moisture regime I_4 as individual factors ma due to adequate supply of nitrogen at constant P and K soil moisture respectively in these treatments. Irrigatio moisture regime I_4 (145 cm) might have played major in increasing plant height since the moisture rema available to the plant adequately during all the veget plant growth stages in this treatment. These observat are also supported by the findings of Biswas Bhatacharya (1987) who concluded that increase in w

Table 1: Yield components of a cultivar rice KSK-385 as influenced by different irrigation levels (Average of two years)

Irrigation levels	Plant height (cm)	No. of panicle bearing tillers hill $^{-1}$	No.of spikelet panicle $^{-1}$	100-grain weight (g)	Grain yield	Straw yield
I_1 10(77.5cm)	124.07^{d}	11.45^{d}	144.0^{d}	18.27^{NS}	3.78^{d}	9.47^{d}
I_2 13(100cm)	128.03^{c}	12.25^{c}	159.13^{c}	18.40^{C}	4.26^{c}	11.83^{c}
I_3 16(122.5cm)	132.59^{b}	12.60^{b}	169.13^{b}	18.61	4.69^{b}	14.50^{b}
I_4 19(145cm)	136.98^{a}	12.97^{a}	177.57^{a}	18.58	4.96^{a}	16.63^{a}

*Any two means in a column not sharing a letter differ significantly at 0.05 P

supply decreased the number of tillers hill $^{-1}$ and occurrence of sterility and increased plant height and 1000-grain weight.

No. of panicle bearing tillers hill $^{-1}$: The panicle bearing tillers hill $^{-1}$ were significantly affected by moisture regimes during both the study years. Maximum no. of panicle bearing tillers hill $^{-1}$ (12.98 and 12.97) was recorded in I_4 (145 cm) during 1992 and 1993 respectively. It was followed by irrigation levels I_3 (12.61 and 12.59) and I_2 (12.31 and 12.19) during 1992 and 1993 respectively. The minimum number of panicle bearing tillers hill $^{-1}$ (11.44 and 11.46) was recorded in irrigation level I_1 during 1992 and 1993 respectively. The more panicle bearing tillers obtained in I_4 (145 cm) may be attributable to the adequate supply of these inputs at these levels. These results are in line with the findings of Aliaga *et al.* (1986) who is of the view that high water table increased plant height, fertile tillers and panicle length due to easy availability of moisture to the plants.

No. of spikelets panicle $^{-1}$: In case of moisture regimes, maximum spikelets panicle $^{-1}$ (175.33 and 179.75) were recorded in I_4 with the minimum (142.00 and 146.00) in I_1 during 1992 and 1993 respectively. Moisture regime I_4 was followed by I_3 (166.25 and 172.00) and I_2 (157.00 and 161.25) during 1992 and 1993 respectively, which differed significantly from each other and from all other treatments. The maximum number of spikelets panicle $^{-1}$ in I_4 treatment may be due to adequate moisture supply through all the plant growth stages.

1000-grain weight: Different moisture regimes did not affect 1000-grain weight during both the trial years.

Grain yield: In moisture regimes, maximum grain yield (4.96 t ha $^{-1}$) was recorded in I_4 treatment. It was followed by the treatments I_3 (4.69 t ha $^{-1}$) and I_2 (4.26 t ha $^{-1}$) that also differ significantly when compared with each other. Minimum grain yield (3.78 t ha $^{-1}$) was recorded in I_1 treatment.

Straw yield: The increase in straw yield recorded in F_4I_4 interaction may be due to appropriate supply of fertilizer and moisture in this interaction that encouraged vegetative growth of the plant resulting in more straw yield. These results are in line with the findings of Ogunremi *et al.* (1986) who reported that high irrigation level increased straw yield due to more vegetative growth. The results are also partly supported by the findings of Alexander and Latif (1988) who documented that grain and straw yields were similar statistically with a minor increase at 3 irrigation level.

Harvest index: Nitrogen x irrigation interaction was significant in two years mean. F_3I_1 interaction gave the highest harvest index (23.57%). It was followed by interactions F_2I_1 (22.80%), F_2I_1 (22.46%), F_3I_2 (22.38%) and F_1I_2 (21.86%) but interactions F_2I_1 (22.46%) and F_3I_2 (22.38%) were at par when compared with each other. The minimum harvest index value (17.03%) was recorded in F_4I_4 interaction. Rest of the interactive values however, were in between. Moisture regime I_4 had significantly lower harvest index at F_4 level, which may be due to more shoot growth. The more harvest index value (23.57%) recorded in F_3I_1 interaction may be attributable to more economic yield and lesser biomass in this interaction. The shoot/vegetative growth should be suppressed and reproductive stage prolonged to get more harvest index values.

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