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Effect of water deficit and nitrogen levels on yield, water-use-efficiency (WUE) and economics of rice (*Oriza sativa* L.)

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ABSTRACT
A field experiment was conducted at Pusa Farm, Rajendra Agricultural University Bihar, Pusa during the year 2000 and 2001 to study the effect of water deficit and nitrogen levels on yield, water-use-efficiency and economics of rice. It is evident from the data that 'So' moisture regime and 120 kg N/ha i.e. 'N_3' level of nitrogen produced significantly maximum grain yield in comparison to lower moisture regimes and nitrogen levels. Water-use-efficiency significantly increased with 'S_1' moisture regime and 120 kg N/ha of nitrogen level i.e. N_3. Higher gross and net return was recorded with 'So' moisture regime and 120 kg N/ha i.e. N_3 nitrogen level. Benefit: Cost ratio was higher with 'S_1' moisture regime but in turn it was at par with 'So' moisture regime. 120 kg N/ha i.e. N_3 nitrogen level which fetched higher B:C ratio than that of their lower nitrogen levels.

Key words : Water deficit, WUE, B:C ratio.

INTRODUCTION
Water and nitrogenous fertilizer are the major inputs for higher production of rice. However, these are expensive inputs and subjected to various losses affecting farmers economy. Thus it was felt imperative to find out appropriate scheduling of irrigation to optimise the water-use-efficiency and yield of rice. Gajbhiye, *et al*. (1990) reported that knowledge on optimum level of soil moisture for plant establishment and growth are important for scheduling irrigation.

Nitrogen is the key nutrient element limiting the yield of rice. Often it has been reported that fertilizers N-use efficiency are very low ranging from 18-40 per cent. Thus judicious and adequate amount of nitrogen is imperative not only to increase grain yield but also economise cost of production and improving economy of rice grower. Keeping this in view, the present study was undertaken to find out the effect of water deficit and nitrogen levels on yield, water-use-efficiency and economics of rice production.

MATERIALS AND METHODS
The field experiment was undertaken during Ph.D. Programme at Pusa Farm, Rajendra Agricultural University, Bihar, Pusa (Samastipur) during year 2000 and 2001 in two consecutive Kharif season. The physico-chemical properties of experimental plot was sandy loam in texture and had pH 8.4, organic carbon (0.31%) and low in available NPK 206.3, 12.3 and 113.8 kg/ha, respectively. The experiment was laid out in a randomized block design having three replication. The experiment consisted of 16 treatments comprising four nitrogen levels (0, 40, 80 and 120 kg N/ha) and four moisture regimes i.e. "S_0' 5±2 cm irrigation after 3 days disappearance of ponded water; "S_1" Irrigation withheld during 10-60 days after transplanting (DAT); "S_2" irrigation with-held during 10-60 and 61-75 DAT; and S_3"- (rainfed) control. 7 cm water was applied during each irrigation according to the treatment. Nitrogen was applied according to treatments but phosphorus and potassium @ 40 and 20 kg/ha, respectively was uniformly applied. The source of nitrogen, phosphorus and potassium were Urea, SSP and MOP, respectively. Crop received one fourth of nitrogen and full dose of phosphorus, potassium and zinc sulphate (25 q/ha) as a basal and remaining half and one-fourth of nitrogen was applied at the time of tillering and panicle initiation period. The water-use-efficiency (kg/ha-cm) was calculated as the ratio of grain yield to the total amount of water used (rainfall + irrigation) and expressed in kg ha^{-1} cm^{-1}. The data of grain and straw yield were recorded and economics was worked out using the prevailing cost of input and market rate of produce.

RESULTS AND DISCUSSION
Grain and straw yield:
Grain and straw yield was significantly increased with different moisture regimes and levels of nitrogen. The maximum grain 32.09 and 36.68 q/ha and straw yield 51.92 and 62.12 q/ha was recorded with "S_0" moisture regime i.e., 5±2 cm irrigation after 3 days disappearance of ponded water and minimum with 'S_3' (rainfed) during the year 2000 and 2001, respectively (Table 1). However, during first year of investigation straw yield of 'S_1' moisture regime was at par with 'So' moisture regime. The percentage increase in grain yield with "S_0" over S_3 (rainfed) was 32.71 and 30.62 during year 2000 and 2001, respectively. This was might be due to favourable moisture condition with "So" moisture regime which increased the growth and yield attributing characters and ultimately increased the grain yield. Similar results was obtained by Patjoshi and Lenka (1998).

There was a significant increased in grain and straw yield of rice with increase in levels of nitrogen (Table 1). Maximum grain (34.82 and 39.96 q/ha) and straw (56.61 and 65.81 q/ha) yield was recorded with 'N_3" nitrogen level i.e., 120 kg N/ha and minimum with 'No' nitrogen level i.e., 0 kg N/ha (Table 1). The maximum grain and straw yield with increasing N-levels might be due to better N-uptake leading to greater dry matter production and its translocation to sink site. The percentage increase of grain yield with 'N_3' over 'No' was 77.74 and 78.15 during 2000 and 2001,

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