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*Short Note*

# Production potential and economic feasibility of irrigated rice based cropping sequences on cultivators' fields under sub-montane low hill conditions of Himachal Pradesh

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Rice-wheat is the most predominant cropping system in Indo-gangetic plains of India which occupies about 10.5 m ha area and contributes 74 per cent of the total food grain production. The system is over-exploitative of the natural resources and consequently leads to degradation in soil health and fertility. This is ultimately leading to decrease in yield of both the rice and wheat over a longer period of time (Woodhead *et al.*1994). Therefore, to break the monotony of the system and to sustain the productivity in a long term perspective, it is essential to identify more productive and profitable cropping systems than rice-wheat under irrigated ecosystem. Keeping the fact in consideration, an experiment on cultivators' fields were conducted to study the production potential and economic viability of the rice based cropping systems under irrigated conditions.

A field experiment on cultivators' field was conducted for two years (2001-02 and 2002-03) at Surajpur, Battamandi, Nihalgarh and Kolar centres of district Sirmour (Farming situation I) and Rajpura and Manpura centres of district Solan (Farming situation II) within NARP Zone I of Himachal Pradesh. Three locations (farmers) at each centre were randomly selected and one trial was laid out at each location. Four rice based cropping sequences viz. rice-wheat, rice-toria-potato, rice-wheat + mustard and rice-oats + berseem (Table 1) were evaluated in randomized block design in a permanent layout at the respective field location. The soils of the zone were inceptisols having texure variying from loamy sand to silty clay loam with pH ranging from 6.0-7.5, organic carbon 0.5-1.0%, available N 200-350 kg/ha, available P 10-25 kg/ha and available K 120-250 kg/ha. The average annual precipitation of the test sites was 1500 mm with mean maximum and minimum temperature ranging from 19.3 to 38.2 & 3.0 to 23.1°C, respectively. The crops in each cropping sequence were raised in accordance with the recommended package of practices. The oats and berseem crop mixture was grown for green fodder. Economics of the crop sequences was computed based upon the prevalent market prices. Yields were harvested from net plot. For comparison between crop sequences, the yields of crops were converted into paddy equivalent on price basis

**Table 1. Main product yield (kg/ha) of different crops under different crop sequences**

| Crop sequence $ | 2001-02 | | | 2002-03 | | |
|---|---|---|---|---|---|---|
| | Kharif | Rabi-I | Rabi-II | Kharif | Rabi-I | Rabi-II |
| | | | Farming situation I (12*) | | | |
| Rice-wheat | 3987 | - | 4233 | 4110 | - | 4520 |
| Rice-toria-potato | 4013 | 634 | 18290 | 4134 | 716 | 19927 |
| Rice-wheat + mustard | 4027 | - | 4155 + 281 | 4103 | - | 4443 + 285 |
| Rice-oats + berseem | 4043 | - | 32899 | 4120 | - | 33407 |
| | | | Farming situation II (6*) | | | |
| Rice-wheat | 3366 | - | 3886 | 3161 | - | 4015 |
| Rice-toria-potato | 3378 | 989 | 14997 | 3183 | 905 | 14292 |
| Rice-wheat + mustard | 3350 | - | 3832 + 166 | 3157 | - | 3985 + 171 |
| Rice-oats + berseem | 3393 | - | 32093 | 3139 | - | 32444 |
| | | | Weighted mean | | | |
| Rice-wheat | 3780 | - | 4117 | 3794 | - | 4352 |
| Rice-toria-potato | 3801 | 752 | 17192 | 3817 | 779 | 18049 |
| Rice-wheat + mustard | 3801 | - | 4047+243 | 3788 | - | 4290+247 |
| Rice-oats + berseem | 3826 | - | 32630 | 3793 | - | 33086 |

$ Rice in all sequences was basmati rice (variety Kasturi) *number of trials

(Verma and Modgal, 1983; Tomer and Tiwari, 1990). Land utilization efficiency was expressed as percentage of days actually used in a year and was worked out by summation of duration of each crop in individual crop sequence divided by 365. Production efficiency values in terms of kg/ha/day were obtained by dividing total production in terms of rice equivalent in a sequence by the total duration of crop in that sequence and production efficiency value in terms of Rs/ha/day were obtained by dividing net monetary return by total duration of crops in a particular sequence. Homogeneity of error variances was tested by using Bartlett $\chi^2$ – test; which were found to be homogeneous. Therefore, the data were pooled and analyzed in randomized block design.

The yield data pertaining to different farming situations have been summarized in Table 1. A perusal of the data revealed that yield of all the crops except toria was higher in farming situation I (Sirmaur) as compared to farming situation II (Solan). Yearly variations in crop yields were very little in the study years 2001-02 and 2002-03. The yield of rice, wheat, toria, potato, mustard and oats + berseem (fodder) ranged between 3984-4134, 4155-4520, 634-716, 18290-19925, 281-285 and 32899-33407 kg/ha in the farming situation I and 3139-3393, 2832-4015, 905-989, 166-171, 32093-32444 kg/ha, respectively in the farming situation II.

The data shown in Table 2 indicate superiority of rice-toria-potato cropping sequence in terms of rice equivalent yield (14980 kg/ha). This was mainly ascribed to higher price of toria as well as higher production of potato grown in the sequence. Rice equivalent owing to rice – oats + berseem sequence was also significantly higher than the prevalent rice-wheat cropping sequence. However, rice-wheat + mustard cropping sequence was statistically at par with rice-wheat sequence in terms of rice equivalent.

Owing to better utilization of applied resources, 'Rice-toria-potato' sequence recorded greater production efficiency in terms of kg/ha/day (51.84) and Rs/ha/day (319) (Table 2). This was followed by 'rice-oats + berseem' sequence in terms of kg/ha/day and rice-wheat + mustard in terms of Rs/ha/day. The lowest production efficiency (25.84 kg/ha/day) was associated with 'rice-wheat' sequence. The land use efficiency ranged between 70 to 79%. Rice-toria-potato and rice- oats + berseem sequences occupied the land for longer duration and had higher land utilization indices than rice-wheat and rice-wheat + mustard sequences.

The economic analysis of the data revealed superiority of rice-toria-wheat (Rs 92145/ha) sequence in fetching highest net return than remaining sequences (Table 2). Higher net return was associated owing to higher yields. The net gains owing to rice-toria-wheat cropping sequence over the prevalent rice-wheat sequence was 88.7 per cent. This was followed by rice-wheat + mustard (Rs 52031/ha) sequence.

**Table 2. Mean seed yield (kg/ha), paddy equivalent yield, LUI and production efficiency of different crop sequences**

| Crop sequence | Mean main product yield (kg/ha) | | | Paddy equivalent yield (kg/ha) | Duration | Return (Rs/ha/year) | | LU E (%) | Production Efficiency | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Kharif | Rabi-I | Rabi-II | | | Gross | Net | | kg/ha/ day | Rs/ha/ day |
| Rice-wheat | 3787 | - | 4235 | 6640 | 257 | 70996 | 48815 | 70 | 25.84 | 190 |
| Rice-toria-potato | 3809 | 766 | 17621 | 14980 | 289 | 137000 | 92145 | 79 | 51.84 | 319 |
| Rice-wheat + mustard | 3795 | - | 4169+245 | 7030 | 257 | 74428 | 52031 | 70 | 27.35 | 202 |
| Rice-oats + berseem | 3810 | - | 32858 | 7800 | 283 | 73446 | 51022 | 78 | 27.54 | 180 |
| LSD (P=0.05) | - | - | - | 1130 | - | - | - | - | - | - |

LUE= Land utilization efficiency

These findings are in conformity with those of Thakur *et al.*(1994) and Chaudhary *et al.* (2001). Thus it is concluded that for higher net income, farmers of low hills can successfully adopt rice-toria-potato cropping sequence with adequate inputs in the irrigated low hill conditions of Himachal Pradesh.

## References


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