# PRODUCTION POTENTIAL, ECONOMICS AND EFFICIENCY OF RICE BASED CROPPING SYSTEM IN RAINFED ACID HILL SOIL OF MANIPUR

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## ABSTRACT

A field study was conducted during 2000-2002 on an acid hill soil (clay loam) under rainfed situation to evaluate the yield, economic profitability and production efficiency of 8 cropping sequences. Rice - potato recorded highest rice-equivalent yield (REY) of 88.57 q/ha followed by groundnut-mustard with a REY of 71.64 q/ha. However, the highest net return of Rs.18,645/ha was recorded with groundnut-mustard sequence. The highest benefit cost ratio (1.08) was recorded with soybean-oats fodder. The highest land use efficiency (LUE) of 72.6% was recorded with soybean oats fodder. The production efficiency was however, superior (35.43 Kg/ha/day) in rice-potato sequence.

For meeting the food requirement of increasing population, the available land has to be intensively cultivated for augmenting agricultural production and sustainability of a crop production system. Cropping sequences is an unique asset to exploit sustainability in food production. Rice based cropping system has assumed paramount importance to meet the dietary habits of 100% population of North Eastern Hills (NEH) Region. Because of non-availability of irrigation facilities in the region, mono cropping of rice is prevalent. Introduction of oilseed and pulses in the system was found more beneficial than mono cropping of cereals (Umarani et. al. 1992 and Jamwal, 2000). A study was, therefore, conducted to assess the possibility of increasing the cropping intensity in the rain fed area, by introducing oilseed and pulses in the cropping system and to increase the productivity and income of the socio-economically poor farmers through suitable cropping system.

## MATERIALS AND METHODS

The field experiment was conducted during 2000-2002 at Krishnagire farm, ICAR Research Complex for NEH Region, Manipur Centre, Imphal. The soil was clay loam with pH 5.0, organic C content > 1.5% and available N.P. and K 11,657, 8.79 and 195.5 Kg/ha respectively. Eight cropping sequences (Table 1) were laid out in randomized block design with 3 replications. The recommended dose of N : P2O5 : K2O Kg/ha were applied @ 60:40:30 to rice (RCM-5); 20:50:20 to field pea (Rachna); 60:30:30 to mustered (RH-30); 100:80:100 to potato (K. Jyoti); 60:40:30 to oats (Kent); 20:60:40 to groundnut (JL-24); 20:40:30 to pigeon pea (ICPL-8) and 20:60:40 to soybean (MACS-13). During rainy season (*kharif*) rice, groundnut, pigeon pea and soybean were sown each year by the first week of May. All Rabi (winter season) crops were sown by the first fortnight of October and were harvested during 2nd fortnight of January to first fortnight of February during both the years. Other required practices like plant protection etc. followed in all treatments equally as and when required. The total rainfall received during the years were 1501.35 and 1610mm respectively. Rainy season (May to first week of October) together contributed more than 90% of the total rainfall and less than 10% of total rainfall was recorded during mid October to April. In general, December and January are the moisture stress period. Rice equivalent yield (REY), land use efficiency (LUE) and production efficiency (PE) were calculated as per the formula given below:

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$$\text{Rice-equivalent yield} = \frac{\text{Yield of produce (q/ha) X price of the produce}}{\text{Price of rice (Rs/ha)}}$$

$$\text{Land use efficiency (\%)} = \frac{\text{Total duration of crop sequence}}{365} \times 100$$

$$\text{Production efficiency (Kg/ha/day)} = \frac{\text{Total grain production/ha in sequence}}{\text{Total duration of crop in a sequence}}$$

## RESULTS AND DISCUSSION

### *Kharif* (rainy season) crops

Among the *kharif* crops, groundnut recorded the highest mean REY of 62.34 q/ha, followed by pigeon pea 55.84 q/ha, soybean 51.39 q/ha and rice + groundnut, 39.39 q/ha Table 1.

### Rabi (Winter)crops

Among the *rabi* season crops, potato recorded the highest mustard equivalent yield of 27.97 q/ha, followed by field pea, oats fodder and mustard, with a mean of 7.41, 7.08 and 6.00 q/ha respectively (Table 1).

### Crop sequence

The highest REY of 88.57 q/ha/year was recorded in case of rice-potato crop sequence, followed by groundnut-mustard (71.64 q/ha), soybean-oats fodder (70.25 q/ha), pigeon pea-mustard (67.84 q/ha), rice-oats fodder (48.83 q/ha), rice + groundnut-mustard (47.85 q/ha) and rice-field pea(45.92 q/ha). The lowest REY of 37.15 q/ha/year was recorded in rice-mustard crop sequence (Table 2).

### Land use efficiency (LUE)

The highest LUE (73.97) was recorded in rice-field pea crop sequence, followed by soybean-oats fodder (72.60), pigeon pea-mustard (69.86) and rice-potato (68.49). It was the least (63.01) in case of rice-mustard groundnut-mustard and rice + groundnut - mustard.

### Production efficiency (PE)

The highest PE of 35.43 Kg/ha/day was recorded with rice-potato crop sequence, followed 31.15 Kg/ha/day with groundnut-mustard crop sequence. The least PE of 16.15 kg/ha/day was recorded with rice-mustard sequence.

### Economics

Groundnut-mustard gave the highest net return of Rs.18,645/ha followed by soybean-oats fodder (Rs.18,216/ha) and rice-potato (Rs.16,500/ha). Inclusion of oilseeds and pulses in rice-based cropping system increased the productivity, monetary return and benefit : cost ratio (Verma and Warsi, 1999).

Thus, rice-potato was found to be the best for the highest PE and groundnut-mustard was found to be the most remunerative crop sequence in rainfed low to mid altitude of Manipur.

## REFERENCES

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Verma, K.P. and Warsi, A.S. 1999. Evaluation of suitable rice-based (oryza sativa) cropping system for central plain zone of Uttar Pradesh, I*ndian Journal of Agronomy* 44 : 444 - 447.

Table 1. Effect of different crop sequences on grain/tuber/fodder yield (q/ha) and on rice and mustard equivalent yield (q/ha)

| Crop sequences | Kharif (rainy season) | | Rice equivalent yield (q/ha) | | | Rabi (winter season) | | Mustard equivalent yield (q/ha) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2000 | 2001 | 2000 | 2001 | Mean | 2000-01 | 2001-02 | 2000-01 | 2001-02 | Mea |
| Rice-field Pea | 28.00 | 34.20 | 28.00 | 34.20 | 31.10 | 5.00 | 4.87 | 7.50 | 7.31 | 7.41 |
| Rice-mustard | 29.60 | 30.17 | 29.60 | 30.17 | 29.89 | 3.55 | 3.70 | 3.55 | 3.70 | 3.63 |
| Rice-potato | 32.48 | 32.78 | 32.48 | 32.78 | 32.63 | 70.00 | 69.83 | 28.00 | 27.93 | 27.97 |
| Rice-oats (Fodder) | 34.17 | 33.40 | 34.17 | 33.40 | 33.79 | 189.29 | 186.75 | 5.68 | 5.60 | 5.64 |
| Groundnut-mustard | 20.26 | 21.30 | 60.78 | 63.90 | 62.34 | 4.56 | 4.73 | 4.56 | 4.73 | 4.65 |
| Pigeon pea-mustard | 13.55 | 14.37 | 54.38 | 57.48 | 55.84 | 5.80 | 6.19 | 5.80 | 6.19 | 6.00 |
| Soybean-oats (Fodder) | 16.44 | 17.82 | 49.18 | 53.48 | 51.39 | 231.50 | 240.00 | 6.95 | 7.20 | 7.08 |
| Rice+groundnut-mustard | 20.00+6.00 | 20.67+6.70 | 38.25 | 40.77 | 39.39 | 231.50 | 186.75 | 4.27 | 4.19 | 4.23 |
| C.D. (P=0.05) | - | - | 3.315 | 3.486 | - | - | - | 1.413 | 1.293 | - |

Table 2. Duration of crops (days), rice equivalent yield (q/ha/year) and economic analysis of different crop sequences (Pooled mean of two years)

| Crop sequences | Duration of crops (days) | Rice equivalent yield (q/ha/year) | Economic analysis | | | |
|---|---|---|---|---|---|---|
| | | | Net return (Rs/ha/year) | Benefit cost ratio (BCR) | Land use efficiency (%) | Production efficiency (kg/ha/year) |
| Rice-field pea | 270 | 45.92 | 5,860.00 | 0.33 | 73.97 | 17.01 |
| Rice-mustard | 230 | 37.15 | 3,475.00 | 0.22 | 63.01 | 16.15 |
| Rice-potato | 250 | 88.57 | 16,500.00 | 0.57 | 68.49 | 35.43 |
| Rice-oats (Fodder) | 245 | 48.83 | 8,792.00 | 0.53 | 67.12 | 19.93 |
| Groundnut-mustard | 230 | 71.64 | 1,864.00 | 1.07 | 63.01 | 31.15 |
| Pigeon pea-mustard | 255 | 67.84 | 15,045.00 | 0.80 | 69.86 | 26.60 |
| Soybean-oats (Fodder) | 265 | 70.25 | 18,260.00 | 1.08 | 72.60 | 26.51 |
| Rice+groundnut-mustard | 230 | 47.85 | 7,210.00 | 0.41 | 63.01 | 20.80 |