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# Efficiency of Paddy Farms in India: an Empirical Evidence of TBP Area of Karnataka state

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**Abstract:**
The study on efficiency of paddy farms revealed that majority of the farmers were operating in medium efficiency level (70%) followed by low efficiency level (17%) and high efficiency level(13%) with respect to nitrogen. Similar trend was noticed in plant protection chemicals wherein farmers operating in medium efficiency level (74%) were higher than those of high (13%) and low efficiency levels (13%). The percentage excess of nitrogen usage over the frontier level ranged from 38.86% to 91.03% and plant protection chemicals from 42.53% to 70.54% with increase in nitrogen levels indicating inputs like nitrogen and plant protection chemicals were used indiscriminately in the study area in view of practice of their own method of cultivation. It is suggested that farmers should be trained about adoption of Integrated Nutrient Management (INM) and Integrated Pest Management (IPM) practices in paddy cultivation in TBP area.
**Key words:** Integrated Nutrient Management, IPM, Paddy, Frontier, MVP, OC, Efficiency

## 1. Introduction:

Paddy is important cereal crop of the World. The United Nations General assembly, in a resolution declared the year of 2004 as the "International Year of Rice", which has tremendous significance to food security. It plays very important role in Indian food basket. Rice is an important food crop of India and stands first in area and second in total food production. Among the rice growing countries, India has the largest area under rice in the world (45.50 million ha) with a total production of 96.43 million tonnes during 2007-08 and it stood next only to China in the world with respect to production. But, the yield levels in India are low at 2.20 tonnes per ha compared to other major rice producing countries viz., Japan (6.52 t/ha), China (6.24t/ha) and Indonesia (4.25t/ha).About67 per cent of the area under paddy in India is under HYV's. (Barath and Pandey, 2005). India is facing challenges to feed its growing population. It is estimated that about 260 million tonnes (MT) of food grains is to be produced annually by 2030 to meet the food requirement. The modern technology introduced in mid-sixties led to "Green Revolution". The new technology in agriculture is envisaged to transform traditional agriculture to modern one. India responded positively to this technical change (Reddy and Sen, 2004).

Karnataka is one of the major rice growing states in India. The area under rice production is increasing over the years. Rice is grown under varied conditions and bulk of the area is under assured rainfall and irrigated conditions under canals (60.52% of gross area irrigated under paddy) and tanks (19.28% of gross area irrigated under paddy). Karnataka ranks fourth in productivity and ninth in production among major rice growing states of the country. The important rice growing area is northern parts of Karnataka. Paddy in the state is grown under different agro-climatic (upland, low land and rainfed) conditions and the crop is damaged by more than 100 species of insect pests of which about a dozen are of significance in India. India loses 30 per cent yield every year (Anon., 2010).

Paddy is one of the most important cereal crop grown in the TBP area of Karnataka. The paddy area under TBP is 3.6 ha in kharif and 2.52 ha in rabi/summer. Single crop is grown in sequence of two to three times in a year in the study area. Nitrogenous fertilizers are the most important contributing factor for the improvement of crop yields since from the past one and half decade. Though farmers are advised by the extension workers to use nitrogenous fertilizers in their fields, they do not accept the recommended doses with much confidence because the physical outcomes of fertilizer application often diverge considerably from those claimed by agricultural scientists. Hence excessive use of chemical fertilizers has resulted in higher plant protection chemicals (Anon., 2008).

It is generally believed that farmers in developing agriculture fail to exploit fully the potential of a technology and/or make allocative errors with the result that yields show wide variation, usually reflecting a corresponding variation in management capacities of the farmers. This shows that considerable scope exists for raising productivity and income of the farmers by improving their efficiency. Further farmers have a tendency to use resources like fertilizer and plant protection chemicals inefficiently which not only builds a high cost structure in the production process but also leads to analyse efficiency and profitability issues in paddy production (Anon, 2009).

In order to enhance the paddy production, it is necessary to understand the input use pattern and their efficiency in production process especially under TBP area. This would help the extension agency to educate farmers in right direction and planners in allocating various resources. Like-wise, a realistic assessment of the production possibilities would indicate the extent and direction in which the imbalance is likely to arise in different crops. Keeping the above issues in view, the present study tries to find out paddy production efficiency in an integrated manner.

## 2. Research Methods:

Tungabhadra dam was constructed and was started in the year 1945 by erstwhile government of Hyderabad and Madras and was completed during the year 1953. After reorganisation of the states, the project became a joint venture of Mysore (now Karnataka) and Andhra Pradesh states. The project is basically envisaged to irrigate 3.63 lakh hectare of drought prone areas of Raichur, Bellary and Koppal districts in Karnataka and 1.60 lakh hectares of Ananthpur, Cuddapah and Kurnool districts in Andhra Pradesh (Anon. 2008).

The study was confined to Tungabhadra Project (TBP) area of Karnataka state. The Tungabhadra project area consists of three districts viz., Raichur, Koppal and Bellary. To get representative sample, the purposive random sampling design was used. In first stage, three talukas were selected based on the highest area under paddy in Tungabhadra project command area namely Sindhanur (Raichur district), Gangavati (Koppal district) and Siruguppa (Bellary district). In the second stage, thirty farmers were randomly selected from each taluka to elucidate required information for the study. Thus the total sample size comprised of 90 farmers. The primary data on paddy cultivation pertained to the agricultural year 2011-2012. The primary data was collected from sample farmers using pre-tested questionnaires prepared for the purpose.

The classification of farmers based on application of nitrogen in paddy cultivation in TBP area than the recommended level was classified as follows.

**Nitrogen level-1**: Sample farmers using upto 50% higher than the recommended dose of nitrogen were grouped under this category.

**Nitrogen level-2**: Sample farmers using more than 50% and upto 100% of recommended dose of nitrogen were grouped under this category.

**Nitrogen level-3**: Sample farmers using more than 100% of recommended dose of nitrogen were grouped under this category.

Measurement of technical efficiency: Using Cobb-Douglas type specification on the frontier an output-based measure of efficiency was evalued.

### 2.1. Resource productivity and allocative efficiency:

The transformation of inputs into output is described by the production function. The per hectare crop production function can be specified as follows.

$$Y = f(X_1, X_2, \ldots\ldots\ldots X_n) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3.1)$$

The Cobb-Douglas production function frame work has been widely used in studies on Indian agriculture (Ekanayake and Jayasuriya, 1987). The Cobb-Douglas type of production function fitted per farm is specified as below and was used for further analysis.

$$Y = a\, X_1^{b1} X2^{b2} X3^{b3} X4^{b4} X5^{b5} X6^{b6} X7^{b7} X8^{b8} x_9^{b9}\, e^{u} \ldots\ldots\ldots\ldots (3.2)$$

Where,

$Y$ = Output
$a$ = Intercept
$X_1$ = Land (acres)

$X_2$ = Seeds (kgs)
$X_3$ = Farmyard manures (tons)
X4 = Human labour (mandays)
X5 = Machine labour (hrs.)
X6 = Fertilizers (Nitrogen in kgs)
X7 = Plant protection chemicals (a.i ml/gm)
X8 = Irrigation (Rs.)
X9 = Micronutrient (kgs)
U = Error term
bi's = Regression coefficients of $i^{th}$ input

The Cobb-Douglas type of production function was converted into log linear form and the parameters were estimated using the ordinary least square (OLS) technique.

$\ln Y = \ln a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + b_6 \ln X_6 + b_7 \ln X_7 + b_8 \ln X_8 + b_9 \ln X_9 + U$………. (3.3)

The regression co-efficients were tested for their significance using 't' test at choosen level of significance while the function as a whole was tested using the 'F' test.

The output elasticity co-efficients of different inputs used in the crop production obtained from production function (equation 3.2) of the respective crops were used to calculate the marginal physical productivity (MPP).

It can be derived as follows.

$$Ep = \frac{MPPX_i}{APPX_i}$$

i.e., $MPPX_i = (bi)(APPX_i)$

$MPPX_i = [(b_i)(Y)] / [X_i]$ …………………….(3.4)

Where,

$MPPX_i$ = Marginal physical product of $i^{th}$ input
$b_i$ = Production elasticity of $i^{th}$ input (Ep)
$APPX_i$ = Average physical product of $i^{th}$ input
$X_i$ = Geometric mean level of $i^{th}$ input
$Y$ = Geometric mean level of output

The marginal value product ($MVPX_i$) of any variable ($X_i$) was the incremental change in the total output expressed in monetary terms brought out by the addition of one unit of $X_i$ keeping other factor level constant.

$MVPX_i = [(b_i)(Y)(P_y)\} / [(X_i)]$ ……………….(3.5)

Where,

$P_y$ represents the output price and other terms are same as defined in equation (3.4).

Timmer measures of technical efficiency:

$$\text{Timmer's measure} = \frac{Y_i}{Y^*_i} \quad \text{…………………………. (3.6)}$$

Where,

$Y_i$ = Actual output of $i^{th}$ farm
$Y_i^*$ = Maximum output obtainable by the $i^{th}$ farm for given levels of input

Kopp's measures of technical efficiency:

$$\text{Kopp's measure} = \frac{X^*_i}{X_i}$$

Where,

$X^*_i$ = Frontier input use
$X_i$ = Actual input use.

If,

$\ln Y = (A) + (b_1 \ln X_1) + (b_2 \ln X_2) + \ldots + (b_n \ln X_n)$

$b_2 \ln X_2 = (\ln Y) - (A) - (b_1 \ln X_1) - (b_3 \ln X_3) - \ldots - (b_n \ln X_n)$

Add $(b_1 \ln X_2) + (b_3 \ln X_2) + (b_4 \ln X_2) + \ldots\ldots\ldots\ldots + (b_2 \ln X_2)$ on both the sides.

$$\sum_{i=1}^{n} \ln X_2 = (\ln Y) - (A) - \frac{(b_1 \ln X_1)}{X_2} - \frac{(b_3 \ln X_3)}{X_2} \ldots\ldots\ldots \frac{(b_n \ln X_n)}{X_2}$$

$$\ln X^*_2 = \frac{(\ln Y) - (A) - (b_1 \ln R_1) - (b_3 \ln R_3) - \ldots\ldots\ldots\ldots - (b_n \ln R_n)}{\sum_{i=1}^{n} b_i}$$

Where,

$$R_1 = \frac{X_1}{X_2}, \quad R_2 = \frac{X_2}{X_2}, \quad R_3 = \frac{X_3}{X_2} \ldots\ldots\ldots\ldots\ldots R_n = \frac{X_n}{X_2}$$

$\ln X_1^*$, $\ln X_3^*$ …………….$\ln X_n^*$ were calculated in the similar fashion.

Classification of Efficiency levels:

High efficiency farmer: Overall mean plus standard deviation of selected input is the value to demarcate the lower range of high efficiency.

Low efficiency farmer: Overall mean minus standard deviation of selected input is the value to demarcate the upper range of low efficiency.

Medium efficiency farmer: Farmers whose selected input usage lies between mean plus or minus standard deviation.

## 3. Results and Discussion:

There has been unanimity among economists for many decades to accept the theoretical description of a production function explaining the maximum amount of output obtainable from a given input bundle with fixed production technology. The maximum output obtainable from a given bundle of inputs gives rise to the production frontier. Its introduction provides finer aspects of a given production process from a practical point of view, compared to the production function (Kautala 1993).

Technical efficiency would be relevant when comparisons are made among the peer group and under similar growing conditions. The farms in a particular location are evaluated for their efficiency by comparing with the 'best' in the location. This is done by shifting the intercept of the average Cobb-Douglas production function upwards to coincide with the most efficient farm and rest of the farms in the location are compared with this both interms of input used and output obtained.

Table 1 revealed that, only land (0.9842) had significantly influenced the production of paddy in general. However, none of the independent variables included had significant influence in nitrogen level 1 eventhough they were positively related except machine labour and nitrogen. It is interesting to note that the nitrogen application had negative and significant influence on production under nitrogen level 2 (-0.0238) and nitrogen level 3 (-0.0211) scenario. Similar pattern was observed in the case of micronutrients. Whereas regression coefficients of plant protection chemicals were positive and significant in nitrogen level 2 (0.0331) and nitrogen level 3 (0.0439).

3.1 Timmer measures of technical efficiency:

Majority of the farmers were operating in medium efficiency level (70%) followed by low efficiency level (17%) and high efficiency level with respect to nitrogen (Fig.1 ). Similar pattern was observed in all the three nitrogen level scenarios- nitrogen level 1 (58%), nitrogen level 2 (82%) and nitrogen level 3 (69%), respectively. About (13% and 17%) of paddy farms were operating in high efficiency level and low efficiency level with respect to use of nitrogen in paddy cultivation (Fig.2 ). Similar trend was noticed in plant protection chemicals wherein farmers operating in medium efficiency level (74%) were higher than those of high (13%) and low efficiency levels (13%). It is estimated that about 74 per cent of the farms were operating in medium efficiency level with respect to plant protection chemicals and about 13 per cent operating in high or low efficiency levels.

It is worth noting that farmers an equal number of farmers were operating in high efficiency level with respect to use of both nitrogen and plant protection chemicals while those operating in low efficiency level were least in all the talukas under Tunghbhadra project command area. The findings of the study are in line with Balappa et al (1998) and Rajasekharan and Krishnamoorthy, 1998) and results of the timmer measures of technical efficiency, in vegetable cultivation, revealed that majority of the farmers were operating in medium level efficiency in all the vegetables at all the locations under study mainly due to practice of traditional cultivation methods. Further, study conducted by (Uday Kumar 2009) **on consequences of plant protection management in paddy in Koppal district and (**Yogeshwari,2002) on economics and environmental implication of pesticide use in paddy in Shimoga district are also revealed similar results. The lack of technical knowledge about improved package of practices, indiscriminate use of inputs might have contributed for this phenomenon.

3.2 Kopp's measures of technical efficiency:

The results from Kopp's measure of technical inefficiency revealed the excess use of resources in view of the existence of technical inefficiency among paddy farms. It was found that actual cost incurred on factors of production considered was in excess of frontier usage of inputs. On an average, the excess use of nitrogen was 63.73 per cent and plant protection chemicals to the extent of 61.49 per cent (Table -2). This implied that, on an average, the output of paddy could be achieved by using 63.73 per cent to 61.49 per cent less than the existing level of inputs, if the farms are on frontier level. The findings of the study are in line with Russel and Young (1983) conducted study on farms in North-West England revealed that approximately 36 per cent of the farms were operating at 75 per cent efficiency levels. In other words, farmers can produce 63.73 and 61.49 per cents of additional output with the existing level of inputs use (nitrogen and plant protection chemicals) in paddy. This indicates that resources were used inefficiently and calls for judicious use of inputs by the farmers to achieve higher level of technical efficiency. Similar study was conducted by Ranaweera and Hafi (1985) revealed that technical efficiency of maize growing farms observed that the mean technical efficiency for the sample was 52 per cent which indicated that the total maize output could almost be doubled if farmers were encouraged to use the best practiced technology and by removing the socio-economic constraints. Further, Kontos and Young (1983) employed frontier production to measure the degree of technical efficiency on a sample of Greek farms. The results revealed that the mean level of efficiency for the sample farms was 57 per cent. Approximately 70 per cent of the farms operated below the 60 per cent efficiency level. The results indicated that substantial gains in total output could be achieved with substantially fewer inputs i.e., 43 percent fewer inputs in average levels.

3.3 Allocative efficiency in paddy production:

To know the allocative efficiency of nitrogen and plant protection chemicals, the ratios of MVP of these resources to their respective MFC were computed. The ratios of MVP to MFC were either greater than one or closer to one in general and however, in the study nitrogen level 1 (-0.895), nitrogen level 2 (-1.005), nitrogen level 3 (-1.036) and overall (-2.596) indicating their overutilization in paddy cultivation (Table-3). Similar situation was observed in the application of plant protection chemicals in nitrogen level 3 as well as overall scenario wherein the ratios of MVP to MFC were either one or more than one. Similar results were noticed in the study conducted by Nagaraj et al. (1994), that the ratio of MVP\MFC was also found to be more in tail reach and less in head reach. Author suggested to farmers in the head reach of canal should reduce the use of human and machine labour and in middle reach should increase use of inputs like seeds, manures and fertilizer and plant protection chemicals. Whereas, contrary to this the study conducted by Eswarprasad et al.(1988) revealed that resource use efficiency in cotton farms in Guntur district of Andhra Pradesh found that marginal value product for pesticide and fertilizers was significantly lower than the opportunity cost. They concluded that excessive use of these two inputs in cotton frames resulted in the lowering marginal value product.

Further, the MVP to MFC ratios in plant protection chemicals in nitrogen level-1 (0.193) and nitrogen level-3 (0.474) were less than one indicating under utililization. Contrary to this study conducted by Nagaraj et al.(1988) on resource use efficiency in different crops in different cropping systems in Tungabhadra command area in Karnataka revealed that the ratio of MVP to factor cost for plant protection chemical was found to be 6.21 in paddy followed by land (2.45) and human labour (2.78). It was suggested that there was scope to increase gross return from paddy in command area by using more of these resources keeping other variables at their respective geometric mean levels of use.

The estimated value of MVP to MFC ratio with respect to nitrogen under different nitrogen scenarios in paddy cultivation with less than one also confirmed the findings of the study that nitrogen was overused in paddy in TBP area. Thus, there was indiscriminate use of nitrogen which might have further resulted in indiscriminate application of plant protection chemicals. Similar results were also obtained by Mahantesh (2002) and Jayaram (1988).It is emphasized that importance should be given on creating awareness and education on judicious use of nitrogen and plant protection chemicals and their ill effects due to excessive use of nitrogen and plant protection chemicals. Department of agriculture, NGO'S, Agricultural Universities and other extension agencies may actively participate in educating the farmers about adoption of organic farming, integrated pest management (IPM) and integrated nutrient management (INM) technologies to overcome the problem of excessive use of inputs in paddy in TBP area.

Excess use of inputs and estimated monetary loss: The quantity of nitrogen loss (Table-4) due to use of nitrogen more than its estimated optimum level increased with increase in the application of nitrogen level in paddy cultivation. Farmers of Tungabhadra Project area have excessively spent Rs.315 and Rs.918 on nitrogen and plant protection chemicals per acre respectively due to over use of these resources. Due to excess use of nitrogen and plant protection chemicals, the overall monetary loss in TBP area is estimated around Rs. 8618.40 lakh.

The estimated loss in plant protection chemicals due to their use more than the optimum level was 1321ml a.i/acre amounting to Rs. 581. Similarly, the loss in plant protection chemicals in nitrogen level 2 (1924.30 ml/gm a.i/acre) and 3 (2687.65) were 45 per cent and 103 per cent more than nitrogen level 1. The similar results were observed in the study conducted by David Pimentel (2005) on economic costs of application of pesticides primarily in United States. The major economic and environmental losses due to application of pesticides in USA was \$1.1 billion per year to public health, \$1.5 billion pesticide resistance in pest, \$1.4 billion crop losses caused by pesticides, \$2.2 billion to bird losses, and about \$2.0 billion to ground water contamination.

The extent of monetary loss due to use of nitrogen and plant protection chemicals more than their optimum levels for the Tungabhadra project command area as a whole was extrapolated. It is evident from the table that overall monetary loss due to use of both nitrogen and plant protection chemicals more than their optimum level was estimated at Rs. 8,618.4 lakhs every year. However, the extent of monetary loss was contributed mainly (67.11%) from loss in plant protection chemicals (Rs. 5,783.4 lakhs) followed by loss from nitrogen (Rs. 2,835 lakhs). The results of the study is on par with study conducted by Dhaliwal and Arora (1996), who have estimated that in India, crop loss due to insect pests was estimated worth Rs. 6000 crores in 1983, which was reported to have further increased to Rs. 29,000 crores in early 1990's.

## 3.4 Conclusion:

Farmers were operating in medium efficiency level (70%) followed by low (17%) and high efficiency level with respect to nitrogen and similar trend was noticed in use of PPC. The percentage excess of nitrogen usage over the frontier level ranged from 38.86% to 91.03% and plant protection chemicals from 42.53% to 70.54% with increase in nitrogen levels. Therefore the extension agencies have to popularize the Integrated Pest Management (IPM) and Integrated Nutrient Management (INM) practices among the farmers of paddy cultivation. Emphasis needs to be given on practicing organic farming, use of biofertilizers and bioagents in paddy production to minimise the usage of plant protection chemicals.

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**Table-1: Production function estimates under different nitrogen scenario in paddy cultivation**

(Per farm)

| Sl. No. | Explainatory variable | Parameters | Regression coefficients | | | |
|---|---|---|---|---|---|---|
| | | | Nitrogen level 1 | Nitrogenlevel 2 | Nitrogen level 3 | Overall |
| 1. | Intercept | A | 1.3738 | 0.5074 | -0.5529 | 4.1143 |
| 2. | Land (acre) | $X_1$ | 0.9909 (0.6901) | 0.3521 (0.5204) | -0.1230 (0.7293) | 0.9842** (0.3123) |
| 3. | Seed (kg) | $X_2$ | 0.0045 (0.1628) | 0.0451 (0.0396) | 0.4397 (0.1443) | 0.0432 (0.0396) |
| 4. | Farm yard mannure (tons) | $X_3$ | 0.0032 (0.0050) | 0.0036*** (0.0027) | -0.0127*** (0.0036) | -0.0010 (0.0019) |
| 5. | Human labour (mandays) | $X_4$ | 0.0157 (0.2730) | 0.1404 (0.1132) | -0.0478 (0.2413) | 0.0246 (0.0826) |
| 6. | Machine labour (hrs.) | $X_5$ | -0.4211 (0.4869) | 0.2422 (0.1340) | 0.4213** (0.2226) | 0.0980 (0.1011) |
| 7. | Nitrogen(kg) | $X_6$ | -0.0216 (0.1021) | -0.0238** (0.0581) | -0.021*** (0.1122) | -0.0222 (0.0415) |
| 8. | PPC (a.i ml) | $X_7$ | 0.0393 (0.0927) | 0.0331** (0.0437) | 0.0439* (0.0468) | 0.0361 (0.0299) |
| 9. | Irrigation (Rs.) | $X_8$ | 0.2822 (0.5822) | 0.2537 (0.3695) | 0.2936 (0.4448) | 0.1033 (0.2409) |
| 10. | Micronutrient (kg) | $X_9$ | 0.0803 (0.0601) | -0.0105** (0.0350) | -0.0963** (0.0440) | 0.0025 (0.0252) |
| 11. | Coefficient of multiple determination | $R^2$ | 0.93 | 0.94 | 0.94 | 0.93 |
| 12. | Adjusted $R^2$ | $R^2$ | 0.92 | 0.93 | 0.93 | 0.92 |
| 13. | Calculated F value | ---- | 100.73 | 126.66 | 117.35 | 216.88 |
| 14. | Returns to scale | ∑bi | 0.97 | 0.98 | 0.60 | 0.28 |

Note: Figures in parenthesis indicate standard errors of respective production co-efficient

* = Significant at ten per cent level

** = Significant at five per cent level of significance

*** = Significant at one per cent level of significance

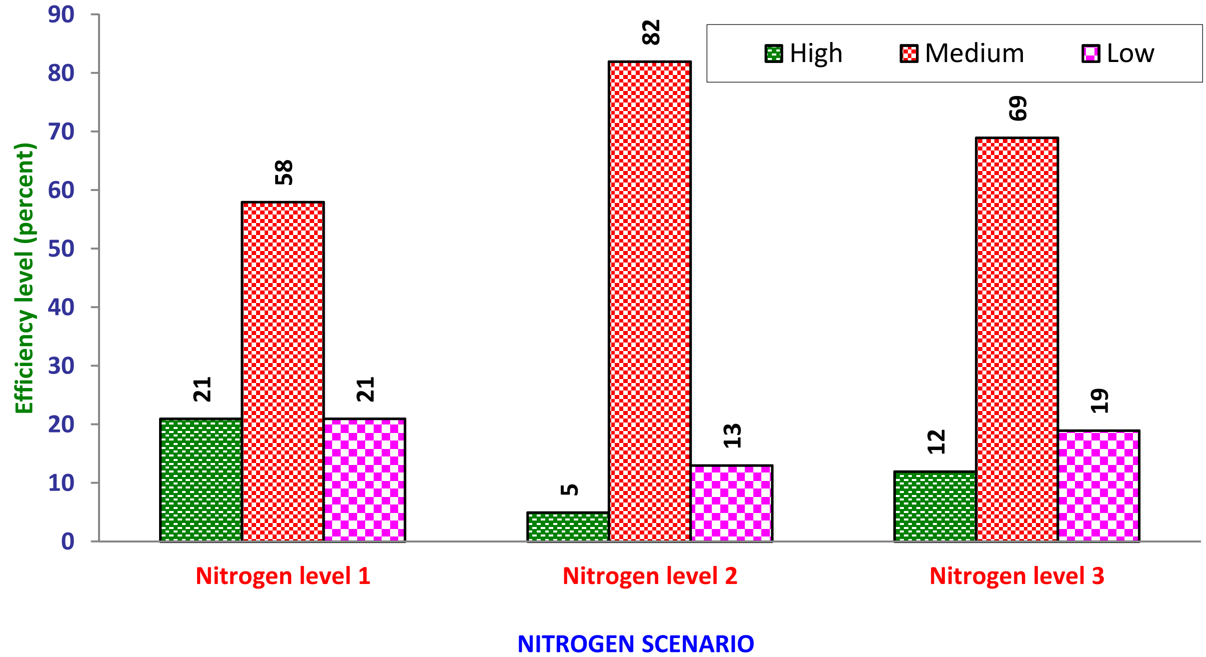


Fig. 1. Technical efficiency of paddy farms (Nitrogen usage)

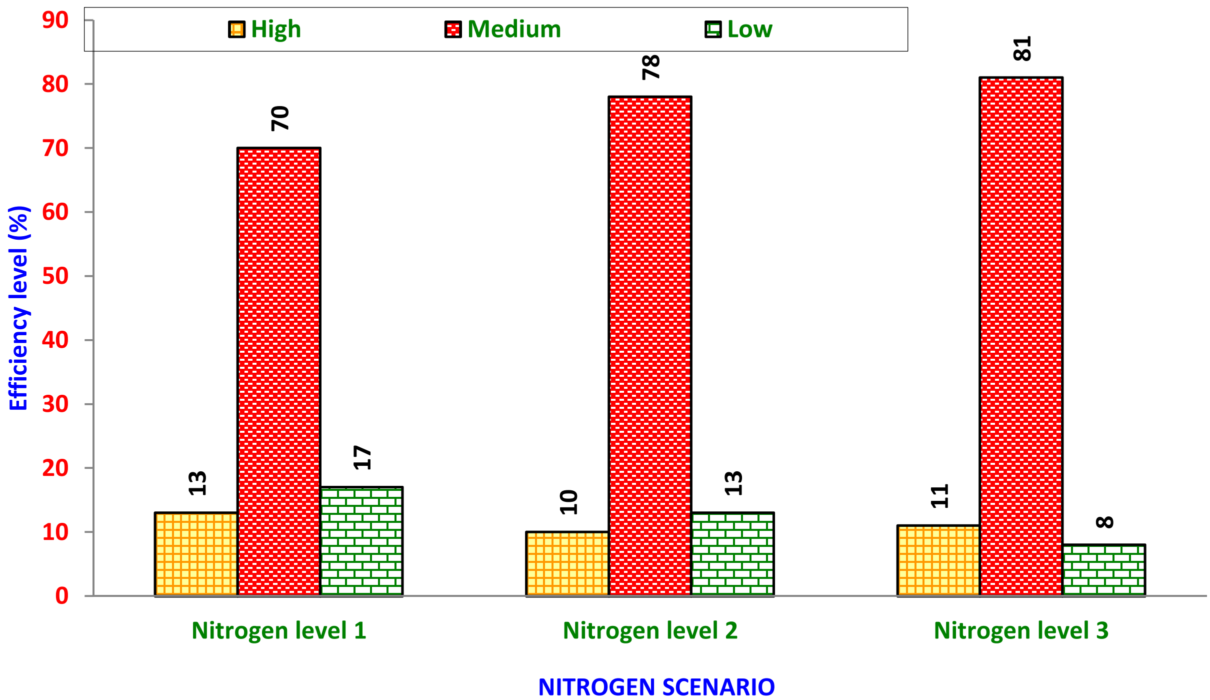


Fig. 2. Technical efficiency of paddy farms (PPC usage)

**Table-2: Actual and frontier usage of nitrogen and plant protection chemicals in paddy cultivation under different nitrogen scenario**

**(Per farm)**

| Nitrogen scenario | Nitrogen (kg) | | | Plant protection chemicals (ml/gm) | | |
|---|---|---|---|---|---|---|
| | Actual | Frontier | %excess | Actual | Frontier | %excess |
| Nitrogen level 1 | 1140 | 821 | 38.86 | 57387 | 40262 | 42.53 |
| Nitrogen level 2 | 1503 | 983 | 52.90 | 71474 | 46535 | 53.59 |
| Nitrogen level 3 | 2151 | 1126 | 91.03 | 84214 | 49382 | 70.54 |
| Overall | 1598 | 976 | 63.73 | 71045 | 43993 | 61.49 |

**Table-3: MVP to MFC ratio in paddy under different nitrogen scenario**

**(Per farm)**

| Sl. No. | Particulars | Nitrogen | Plant protection chemicals |
|---|---|---|---|
| 1. | Nitrogen level 1 | -0.895 | 0.193 |
| 2. | Nitrogen level 2 | -1.005 | 0.474 |
| 3. | Nitrogen level 3 | -1.036 | -1.036 |
| 4. | Overall | -2.596 | -0.962 |

**Table-4: Estimated monetary loss from use of more than optimum level of nitrogen and plant protection chemicals in TBP area as a whole**

| Sl. No. | Particulars | Nitrogen level 1 | Nitrogen level 2 | Nitrogen level 3 | Overall |
|---|---|---|---|---|---|
| **1.** | **Percentage area under different nitrogen scenario** | 26.67 | 44.45 | 28.89 | 100 |
| **2.** | **Total area under paddy** | | | | |
| | a) Kharif (lakh acre) | 2.4 | 4.0 | 2.6 | 9 |
| | b) Rabi/summer(lakh acre) | 1.68 | 2.80 | 1.82 | 6.3 |
| **3.** | **Relative monetary loss (Rs./acre)** | | | | |
| | a) Nitrogen | 161 | 263 | 519 | 315 |
| | b) Plant protection chemicals | 581 | 847 | 1183 | 918 |
| **4.** | **Total monetary loss in TBP area (lakh Rs.)** | | | | |
| | a) Nitrogen | 386.44 (28.35) | 1052.00 (30.72) | 1349.4 (38.52) | 2835 (32.89) |
| | b) Plant protection chemicals | 976.08 (39.59) | 2371.89 (69.27) | 2153.02 (61.47) | 5783.4 (67.11) |
| | c) Total | 1362.65 (100.00) | 3423.89 (100.00) | 3502.4 (100.00) | 8618.4 (100.00) |