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**AGRICULTURE ECONOMICS**

# An Economic Analysis of Net Returns from Major Crops in Central Dry Zone of Karnataka under Different Valuation Approaches

Hamsa, K.R.* and Srikantha Murthy, P.S.

Department of Agricultural Economics, University of Agricultural Sciences, Bengaluru, Karnataka, India

*Corresponding author: hmmshamsa@gmail.com

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**ABSTRACT**

The economic distortions introduced by systems of subsidies, incentives for inputs, products, services, mis-allocation of resources and inefficiency can affect the economically optimal crop pattern. Present study explored the analysis of net returns under different valuation approaches *viz.*, market price approach, economic price approach and natural resource valuation approach in central dry zone of Karnataka. A total of 90 structured questionnaires were used to gather the data necessary for analysis. Results reveal that, net returns were positive based on all the three approaches of market prices, economic prices and natural resources valuation without inclusion of cost of water, except in ragi. The more reduction in the net returns at economic prices was observed in case of paddy under borewell irrigation, indicating that the distortion was more due to subsidies on fertilizers (₹ 8883 per crop) and energy for pumping irrigation water (₹ 7930 per crop). The net returns from groundnut under natural resource valuation was higher (₹ 10,450) without considering the value of ground water, when compared to the net returns at economic prices because of inclusion of nitrogen value in net returns from the crop (₹ 1107). The net returns were negative with inclusion of water cost in all the crops except irrigated groundnut. This shows that, due to prohibitive cost of groundwater, the net returns are not remunerative for crops like paddy, maize and ragi.

**Highlights**

- Market distortions influenced by subsidies and price support offer non-natural advantages to cultivate different crops in different periods. Crops considered for this study were ragi, maize, groundnut in rainfed situation where as ragi, maize, groundnut and paddy were considered in irrigated situation. At normal market price situation it is subsume of subsidies but it will not reflect the true net returns. Therefore deduction of subsidies from market returns gives the economic returns. Now a days sustainability is an important challenge, in this regard net returns was worked out according to natural resource valuation technique by considering nitrogen fixation value in legumes and GHG emission cost. And value of groundwater is captured under natural resource valuation technique with water cost. With all these approaches ,there was a decrease in the net returns but crop like groundnut showing positive net return implies still can grow groundnut in CDZ.

**Keywords:** Net returns, market price approach, economic price approach, natural resource valuation approach, groundwater cost

Agriculture is the backbone of Indian economy. About 60% of the population depend on agriculture for their livelihood. India accounts for 2.4% of the world geographical area and has to feed about 17% of the population in the world (Anonymous 2016). The challenges have been emerging on Indian agriculture to meet the food requirement of increasing population. Accelerating the growth

of agriculture production is therefore necessary to meet the rising demand for food, but also to increase income of those dependent on agriculture to ensure inclusiveness.

The validation for cropping pattern followed by farmers which is influenced by the market prices of factors and products. However, due to economic distortions introduced by systems of subsidies, incentives for inputs, products, services, misallocation of resources and inefficiency can affect the economically optimal crop pattern. Further the incentive structure may also lead to indiscriminate use of land and water resources adversely affecting equity and sustainability. Distortions through assured marketing and subsidized inputs such as water, without economic pricing can result in inefficient use.

Agricultural activities are the main user of water from surface to ground water in rural areas. Groundwater accounts for more than 60 per cent of India's irrigated area (Rohith *et al.* 2015). In addition to rational water use, there is a need for selecting economically viable cropping patterns for a given area and available resources. This study is a modest attempt to find the net returns under different valuation approaches *viz.*, market price approach, economic price approach and natural resource valuation approach improving natural resource sustainability across production environments.

## METHODOLOGY

### (a) Nature and sources of data

Random sampling technique was employed in the selection of farmers for the study based on major crops grown *i.e.*, field crops, commercial crops and other crops. Tumakuru district which comes under Central Dry of Karnataka (CDZ) was selected purposively because the major crops grown in that area are paddy, ragi, maize and groundnut under irrigated condition and some of these crops were water intensive and more fertilizer responsive. Primary data were collected from the 90 sample farmers comprises of rainfed and borewell irrigated with 45 respondents in each group for the agricultural year 2013-14. Secondary data was collected from the District website and Directorate of Economics and Statistics (DES), Government of India for the year 2013-14.

### (b) Market pricing, economic pricing and natural resource valuation

Net returns according to market prices, economic prices, natural resource valuation was worked out. Valuing the nitrogen fixation on the positive side and green house gas (GHG) emissions on the negative side, as well as natural resource valuation considering cost or value of groundwater used were worked out as under:

In the first step, the crop wise cost $A_1$ plus imputed value of family labour per ha which includes cost of seeds, fertilizers, manure, human labour (hired, attached and family), animal labour (hired and owned), machine labour (hired and owned), irrigation, plant protection chemicals, interest on working capital @12.5% for the duration of crop, land revenue, taxes, cesses charge, depreciation on implements and farm buildings. Since, the farmers are not paying for electricity in the case of borewell irrigated crops, the pumping expenditure was estimated (Hamsa 2016, Rohith 2015, Rashmi 2015).

Cost of pumping groundwater = working hours of irrigation pumpset x horse power of the irrigation pumpset × 0.75 KWH × ₹ 3.5 per KWH.

### (c) Net returns according to market prices

The cost of cultivation according to market prices considers the subsidy on inputs such as fertilizers and water. Thus, the energy used for pumping irrigation water is also subsidized by the State. Thus, these are the two major inputs provided by the State/Central. The net returns according to market prices are then calculated by deducting cost $A_1$ + imputed value of family labour from the gross returns. It is obvious that the net returns according to market prices includes subsidy on nutrients and energy for pumping irrigation water. Therefore this is a market distortion to the extent of subsidy offered. This implicitly includes the market price support since; the market price will subsume its effects.

### (d) Net returns according to economic prices

The net returns according to economic prices include the value of fertilizer subsidy[1] as a cost

and in the case of borewell irrigated crops, the net returns according to economic prices, includes the pumping expenditure as irrigation subsidy.

### *Estimation of subsidy on irrigation water*

Considering water for irrigation, in the case of groundwater irrigation, the subsidy is in terms of pumping cost. Here, if a pump of 1 HP capacity is run for one hour, then it consumes the energy equal to 0.75 KWH. At present, the cost of one KWH is ₹ 3.5.

Pumping cost subsidy = Number of pump hours for each crop × HP of the pump × 0.75 × ₹ 3.5.

### *Estimation of subsidy on fertilizers*

The net returns according to economic prices include the value of fertilizer subsidy[2] as a cost. This data has been used for calculating the extent of subsidy for each crop depending upon the extent of use of nutrients through fertilizers used. Thus, for calculating the cost of cultivation and net returns according to economic prices, the subsidy on nutrients and irrigation water should be accounted by adding to the cost of cultivation according to market prices. This is same as deducting the subsidy on nutrients and water from the net returns calculated according to market prices.

### (e) Net returns according to natural resource valuation

The net returns according to natural resource valuation included items such as (1) value of $N_2$ fixed in the case of leguminous crops as a benefit, (2) the value of GHG emissions as a cost and (3) the value of water used in irrigation as a cost. The value of $N_2$ in the case of leguminous crops is considered as ₹ 42.57 per kg of $N_2$ fixed (Table 2). The cost of GHG emission is the cost of $CO_2$ emitted considered as ₹ 0.46 per kg which is the environmental cost. Thus amount of carbon emitted by each crop in kgs per ha (Pardis 2014) is multiplied by ₹ 0.46 to obtain the environmental cost due to GHG emission (Table 1).

In order to obtain the value/cost of water used in borewell irrigation, as the case may be, the source(s) of information and procedure followed is as under.

**Table 1:** Cost of carbon foot print (GHG emission) by different crops

| Crops | Carbon foot print(t/ ha/year) | Cost of carbon foot print (₹ /ha/year) |
|---|---|---|
| | *Cereals* | |
| Paddy (IR) | 4.1 | 1899 |
| Ragi (UI) | 0.07 | 32 |
| Maize (IR) | 0.17 | 78 |
| Maize (UI) | 0.14 | 64 |
| | *Commercial crops* | |
| Groundnut (UI) | 0.04 | 19 |

***Note:*** *UI: Un Irrigated, IR : Irrigated.*

***Source****: Assessment of carbon footprint of agriculture production system of Karnataka and Afghanistan, Pardis, 2014, cost of one kg of carbon foot print =* ₹ *0.4632 (NIAP)*

**Table 2:** Value of nitrogen fixation by pulse crops (₹ / ha)

| Sl. No. | Pulse crop | Amount of nitrogen fixation(Kg/ha) | Average amount of nitrogen fixation (Kg/ ha) | Value of nitrogen fixation (₹ /ha) |
|---|---|---|---|---|
| 1 | Pigeon pea | 16-35 | 25.5 | 1086 |
| 2 | Soybean | 58 | 29 | 1235 |
| 3 | Cowpea | 30-96 | 63 | 2682 |
| 4 | Gram | 19-108 | 63.5 | 2703 |
| 5 | Cluster bean | 50 | 25 | 1064 |
| 6 | Peas | 72 | 36 | 1533 |
| 7 | Lentil | 35-100 | 67.5 | 2874 |
| 8 | Greengram | 50-55 | 52.5 | 2235 |
| 9 | Blackgram | 38-50 | 44 | 1873 |
| 10 | Lucerne | 60-120 | 90 | 3832 |
| 11 | Groundnut | 12-52 | 26 | 1107 |

***Source:*** *Package of practice (2014), UAS Bangalore;* www.fert.nic.in

### (f) Cost of groundwater irrigation

In order to obtain the cost of groundwater irrigation, amortization of investment on drilling and casing was performed to obtain variable cost of irrigation over the average life of irrigation well. In addition, amortization of investment on pumps, pump house and accessories was performed to obtain fixed cost. The cost of groundwater irrigation is the amortized

**Table 3: Economics of crops considering market prices, economic prices, natural resource valuation with and without cost of groundwater in Tumakuru district (2014-15). (₹/ha)**

| Crop | Cost A1+ IVFL | NRMP (₹ ) | Subsidy | | NREP (₹) | N fixation | GHG cost | NRNRVT (₹) | Water cost | NRNRVTW (₹) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Fertilizer | Energy | | | | | | |
| *Rainfed crops* | | | | | | | | | | |
| Maize | 41398 | 11570 | 4484 | 0 | 7086* | — | 65 | 7021 | 0 | 7021 |
| Ragi | 38023 | -2440 | 3442 | 0 | -5882* | — | 33 | -5915 | 0 | -5915 |
| Groundnut | 47274 | 5186 | 4837 | 0 | 349* | 1107 | 19 | 1437 | 0 | 1437 |
| *Borewell irrigated crops* | | | | | | | | | | |
| Paddy | 56225 | 34091 | 8883 | 7930 | 17278** | — | 1899 | 15379 | 41500 | -26120 |
| Maize | 49577 | 31405 | 7375 | 1470 | 22560** | — | 79 | 22481 | 25938 | -3456 |
| Ragi | 46319 | 13552 | 5995 | 735 | 6822** | — | 33 | 6789 | 10375 | -3586 |
| Groundnut | 51619 | 17131 | 6665 | 1103 | 9362** | 1107 | 19 | 10450 | 10375 | 75 |

**Note:** *NRMP (Net returns based on market prices) = Gross Income minus (Cost A1+Imputed Value of Family Labour);*
*NREP (Net returns based on economic prices) = NRMP minus (Fertilizer subsidy+ Electricity subsidy)*
** NREP (Net returns based on economic prices) = NRMP minus Fertilizer subsidy*
*** NREP (Net returns based on economic prices) = NRMP minus (Fertilizer subsidy+ Electricity subsidy)*
*NRNRVT (Net returns based on Natural resource valuation technique) =NREP +Nitrogen fixation value – GHG emission cost*
*NRNRVTW (Net returns based on Natural resource valuation technique with water cost) = NREP + Nitrogen fixation value – GHG emission cost – Water cost*

cost of irrigation given by amortized cost on borewell + amortized cost on IP set + amortized cost on conveyance structure + amortized cost on storage structure if any + repairs cost of IP set.

Here, AL= Average age or life of borewell, i = discount rate taken at 2% (Diwakara *et al.* 2007). The historical investment/s on wells/borewells is/ are compounded to the present, in order to have the total investment on all wells as if made at present. Using the detailed methodology[2], the cost of groundwater irrigation in Central Dry Zone of Karnataka averaged to around ₹ 417 per ha cm or per acre inch for the year 2013-2014 (Patil 2014).

## RESULTS AND DISCUSSION

### Cost of cultivation of crops considering market prices, economic prices and natural resource valuation concept

The cost of cultivation of the crops using the market price, economic price and natural resource value concept were illustrated in the Table 3. The higher cost of cultivation (₹ 47274 per ha) was observed for groundnut under rainfed condition and paddy (₹ 56225/ha) under irrigated condition. With respect to net returns at market prices, higher returns were found in the case of maize (₹ 11570/ha) under rainfed condition and paddy (₹ 34091/ha) under irrigated condition.

Net returns at economic prices are also computed by deducting the subsidy amount on the fertilizer and subsidy on energy cost in groundwater irrigation from the net returns at market prices. Accordingly, at economic prices, the more net returns were obtained from maize (₹ 7086/ha) under rainfed condition and paddy (₹ 17278/ha) under irrigated condition. The net returns realized from economic prices are obviously lower than that of return by market prices, due to deduction of subsidies. There has been a substantial decrease in net return in economic prices in paddy under borewell condition due to subsidy on fertilizer and energy cost for pumping groundwater.

Net returns at natural resource valuation without water cost is obtained by deducting the GHG emission cost and adding the value of nitrogen fixed by legumes. Except for ragi (₹ -5915), the net returns were found to be positive for all crops in rainfed condition. In the case of borewell irrigated condition, the net returns was positive for all the crops.

Net returns at natural resource valuation with water cost is obtained by deducting the GHG emission cost, adding the value of nitrogen fixed by legumes

and deducting the water cost. In irrigated condition, except for groundnut, the net returns (₹ 75 /ha) for all crops are negative in Tumakuru district with the consideration of cost of groundwater irrigation in natural resource valuation technique.

## CONCLUSION AND POLICY IMPLICATIONS

Present study explored the analysis of net returns under different valuation approaches *viz.*, market price approach, economic price approach and natural resource valuation approach in central dry zone of Karnataka. Expect ragi, the net returns for all the crops in CDZ were positive based on all the three criteria's. In economic criteria, due to distortion of subsidies on fertilizers (₹ 8883 per crop) and for pumping irrigation water (₹ 7930 per crop), the decrease in the net returns was observed in case of paddy under borewell irrigation. Under natural resource valuation, the net returns from groundnut was higher (₹ 10,450) when compared to the net returns at economic prices, because of inclusion of nitrogen value in net returns from the crop (₹ 1107). And natural resource valuation including groundwater cost,the net returns were negative in all the crops except in irrigated groundnut. This shows that, due to prohibitive cost of groundwater, the net returns are not remunerative for crops like paddy, maize and ragi. Farmers need to cultivate alternative crops under borewell irrigated condition. This shows that, since the farmers are not still technically efficient in realizing positive net returns under ground-water irrigated condition, support through subsidizing energy cost needs to be continued.

## END NOTES

1 Provided by National Institute for Agricultural Economics and Policy research, IARI, New Delhi that the subsidy per kg of $N_2$ = ₹ 20.87; that per kg of $P_2O_5$ = ₹ 18.67; per kg of $K_2O$ = ₹ 15.50.

2 *Ibid.*

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