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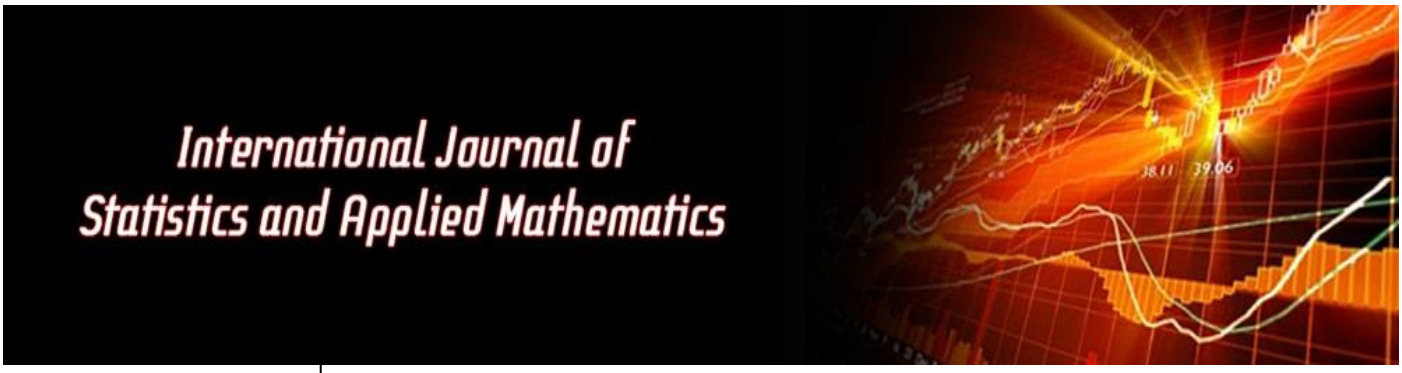


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# Economic impact of UASB Released Paddy Hybrid (KRH-4) on farmer's income: An empirical evidence from southern dry zone of Karnataka

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**Abstract**
Technological interventions in agricultural sector directly target farmers, with the objective of increasing agricultural productivity and profitability. From the time of green revolution, many research institutes in India have been focusing on research in paddy to develop high yielding varieties and improve farmers' income. Zonal Agricultural Research Station, Mandya, under the canopy of University of Agricultural Sciences Bengaluru (UASB), is one such institute which is continuously engaged in developing high yielding paddy varieties suitable to agro-climatic zones of Karnataka. KRH-4 paddy hybrid, which was developed and released by UAS Bangalore, is popular among farmers because to its high yielding nature. Assessing the economic impact of technological interventions is the challenging task for economists. In this study, the Southern dry zone (SDZ) of Karnataka was selected for studying the economic impact of KRH-4 paddy hybrid on farmers income. The survey was conducted on 100 sample respondents which constitutes 50 farmers growing KRH-4 paddy and 50 farmers growing Meenakshi paddy (Check). Cost and return analysis, Partial Budgeting and Production function analysis were used to analyse the data collected. The results of the study revealed that, the yield realized by the farms growing KRH-4 paddy was higher (74.50 q/ha) compared to Meenakshi cultivating farms (67 q/ha). The farmers growing KRH-4 paddy have gained 15 per cent higher net returns (Rs. 13,408) over check variety. The threshold yield level of KRH-4 paddy has increased by 0.166 quintals per farm as revealed by the significant coefficient for dummy variable. The farmers cultivating UASB released KRH-4 paddy have realized higher yield and returns compared to farmers cultivating check. Therefore, the intensive efforts are needed to popularize and encourage the widespread adoption of KRH-4 paddy to realize full potential of the crop productivity and to augment farm income.

**Keywords:** Paddy, KRH-4, partial budgeting, impact and income

## Introduction
Food is the prima facie basic universal necessity for every species without any exception. If one dwells upon the population trends at the global level, the population was 1.6 billion in 1900; 2.5 billion in 1950; 6 billion at the start of this millennium i.e., in 2000[1] and now it is knocking at the 8 billion mark. Conversely, the total crop land was 0.93 and 1.51 billion hectares in 1900 and 2000, respectively, and now it just hovers around 1.5 billion hectares [2]. Looking at these trends it can be inferred that, the population has inflated by many folds, but the area under crops has not seen a significant gain, even though a little stride has been made, it is largely at the expense of nature as land is a fixed factor and there are no chances of increasing the land. Therefore, research in augmenting the food production and land productivity plays a crucial role in feeding the ever-inflating population with never inflating land resource. The stand out contribution of agriculture sector in the economy during the COVID-19 pandemic, when every other sector of the economy stood still seemed like an illuminating star in the blue sky and this underpins the fact- 'everything can stop but not the agriculture'.
Paddy, often known as 'rice' is India's most important staple food crop. India is the world's second-largest paddy grower after china. In India, paddy is cultivated over an area of 4.37 lakh hectares with a production of 1.19 lakh tonnes and productivity of 27.22 quintals per ha during 2019-20 [3].

Paddy has taken the top most share in the total food grain procurement (857.30 Lakh tons) with procurement expenditure of Rs. 1.67 lakh crores [4] by the government in 2021-22, which shows how paddy has provided livelihood to the tens of thousands of growers, apart from that rice is the main constituent of the Public Distribution System (PDS) largest of its kind in the world, which is feeding millions of poor. Thus, rice has the prominent place in reducing food insecurity of the nation.

Technological and policy interventions in agricultural sector directly target farmers, with the primary objective of increasing agricultural income and profitability that could be realised through increased agricultural production and productivity. Towards this end, the interventions could be an introduction of a new variety, improvement in the crop management, water management, training the farmers, post-harvest management, farmers credit or improved access to market, etc. One of the most notable achievements of Indian agriculture over the last few decades has been the expansion of food grain output from nearly 51 Million Tonnes (MT) in 1950-51 to over 308 MT in 2020-21 [5], a begging mouth turning into a helping hand, due to sustained support for agricultural research by the national planners for the development of high yielding varieties (HYVs) and hybrids through different research stations and institutes across the country.

It is a challenging task for economists to assess the economic impact of technological interventions. The discipline of agricultural economics provides the rationale and the methodology to compute the economic impact. Policy makers seek answers from recipients of research funds like the SAUs / ICAR institutes for a reflection of economic impact of their technologies / innovations. Scientists endeavour in generating new technologies and upon generation, releasing them for farmers' use through their respective Zonal Research and Extension Councils.

From the time of green revolution to present time, many research institutes in India have been focusing on research in paddy to develop high yielding varieties and improve farmers' income. Zonal Agricultural Research Station, Mandya, under the canopy of University of Agricultural Sciences Bengaluru (UASB), is one such institute which is continuously putting efforts to develop high yielding paddy varieties suitable to different agro-climatic zones of Karnataka. KRH-4 paddy hybrid was developed by N. Shivakumar, a famous rice breeder from UAS Bangalore and the hybrid was released in the year 2012 after continuous research for 10 years. KRH-4 is a high yielding, less responsive to fertilizer and less water requiring paddy hybrid. According to scientists, KRH-4 has covered nearly 10 per cent of the area under paddy cultivation in southern districts of Karnataka and is popular among paddy growing farmers because to its high yielding nature. KRH-4 paddy hybrid was chosen for in depth analysis of its economic impact on farmer's income in the present study.

## Materials and Methods

### Study area and data

The Southern dry zone (SDZ) of Karnataka was selected for studying the economic impact of UASB released paddy hybrid (KRH-4). The SDZ was selected purposively for the study as major research activities of UASB are based in southern districts of Karnataka and paddy is one of the major crops grown in this zone. The survey was conducted on 100 sample respondents which constitutes 50 farmers growing KRH-4 paddy and 50 farmers growing Meenakshi paddy. Meenakshi paddy is chosen for comparative study (Check) as it is also grown largely in the study area because of its high yielding and fertilizer responsive nature. The pertaining to, economics of paddy production, inputs use, yield etc. were collected from sample farmers for the agriculture year 2020-21 by using pre-tested, structured interview schedule.

### Estimation of costs and returns of paddy production

Cost of cultivation was arrived at by considering both variable and fixed costs as well as explicit and implicit costs. Under the variable costs; labour cost (both family and hired), cost of inputs and interest on working capital were calculated. Under the fixed cost, rental value of land, depreciation (straight line method was used), interest on fixed capital, land revenue and taxes are computed. Gross returns from paddy production, net returns over total cost, cost of production per quintal and returns per rupee of expenditure are calculated.

### Partial budgeting

A simple yet powerful tool partial budgeting technique was used to estimate the direct economic benefit (or loss) at farm-level by adoption of UASB released KRH-4 paddy. It focuses only on the changes in income and expenses that would result from implementing an alternative technology. Thus, all components of farm profits which remain unchanged by the decision were not considered. In this study, the impact of KRH-4 paddy on income level of farmers is evaluated by considering the additional costs incurred in adoption of KRH-4 paddy and decreasing in gross returns (if any) were used under debit. Decrease in cost if any by adoption of KRH-4 paddy and incremental returns realized (if any) were taken under credit as shown in Table 1. Sum of credits were subtracted from the sum of debit to arrive net gain or loss.

**Table 1:** Partial Budgeting

| Debit | Credit |
|---|---|
| Increase in cost due to adoption of UASB released variety = A<br>Decrease in gross returns due to adoption of UASB released variety = B<br>Total = A+B | Decrease in cost due to adoption of UASB released variety = C<br>Increase in gross returns due to adoption of UASB released variety = D<br>Total = C+D |
| Credit-Debit = Net gain / loss | |

## Results and Discussions

The proportion of working expenses was marginally higher for farmers growing KRH-4 paddy (Rs. 63812) compared to Meenakshi farms (Rs. 61667) which accounted for 80.76 per cent and 80.28 per cent, respectively. The proportion of fixed cost incurred in KRH-4 (19.24%) paddy cultivation was marginally less than that for Meenakshi (19.72%) but in absolute terms the respective fixed cost was Rs. 15202 and Rs. 15153, respectively. The higher cost of cultivation for KRH-4 variety was attributable to a greater number of labour used for crop maintenance and expenditure towards machine labor, seed and FYM. Among different items of costs in paddy cultivation, human labour cost was the major on the farms growing both KRH-4 (33.92%) and control variety (32.28%), which worked out to be Rs. 26800 and Rs. 24800, respectively.

**Table 2:** Cost incurred in cultivation of KRH-4 and Meenakshi paddy hybrids in the study area (Per ha)

| Particulars | | | KRH-4 | | | | Meenakshi (Check) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Quantity | Rate (Rs.) | Cost | Per cent | Quantity | Rate (Rs.) | Cost | Per cent |
| **A** | **Variable cost** | | | | **63812** | **80.76** | | | **61667** | **80.28** |
| 1 | Human Labour (md) | | 67.00 | 400 | 26800 | 33.92 | 62 | 400 | 24800 | 32.28 |
| 2 | Seed (Kg) | | 27.00 | 75 | 2025 | 2.56 | 31 | 80 | 2480 | 3.23 |
| 3 | Tractor (Hrs) | | 8.25 | 900 | 7425 | 9.40 | 7 | 900 | 6300 | 8.20 |
| 4 | Bullock (Days) | | 7.90 | 800 | 6320 | 8.00 | 9.8 | 800 | 7840 | 10.21 |
| 5 | Fertilizer (Rs.) | | | | 3550 | 4.49 | | | 4203 | 5.47 |
| 6 | FYM (Tractor loads) | | 2.1 | 3000 | 6300 | 7.97 | 1.8 | 3000 | 5400 | 7.03 |
| 7 | Plant protection chemicals | | | | 1380 | 1.75 | | | 1520 | 1.98 |
| 8 | Irrigation | Water cess | | | 230 | 0.29 | | | 230 | 0.30 |
| | | Labour | 15 | | 6000 | 7.59 | 13 | | 5200 | 6.77 |
| 9 | Interest on working capital @ 7 per cent | | | | 3782 | 4.79 | | | 3694 | 4.81 |
| B | Fixed cost | | | | 15202 | 19.24 | | | 15153 | 19.72 |
| 1 | Land revenue and taxes | | | | 50 | 0.06 | | | 50 | 0.07 |
| 2 | Depreciation cost | | | | 1510 | 1.91 | | | 1565 | 2.04 |
| 3 | Rental value of land | | | | 12260 | 15.52 | | | 12160 | 15.83 |
| 4 | Interest on fixed capital @ 10 per cent | | | | 1382 | 1.75 | | | 1378 | 1.79 |
| C | Total cost | | | | 79014 | 100 | | | 76820 | 100 |

The cost of machine labour measured in terms of tractor hours was found to be comparatively higher on farms growing KRH-4 (9.40%) compared to Meenakshi (8.20%) growing farms. While, farmers growing Meenakshi spent more on chemical fertilizers (Rs. 4203) compared to KRH-4 growing farmers (Rs. 3550). The lower fertilizer cost incurred by farmers growing KRH-4 was compensated by higher cost on FYM (Farm Yard Manure) in the case of KRH-4 growing farms (Rs. 7200) compared to Meenakshi (Rs. 5400).

**Yield and returns from paddy cultivation**

The results on yield and returns realized from paddy cultivation are given in Table 3. The yield realized on respondents' farms was higher in case of KRH-4 paddy (74.50 q/ha) compared to Meenakshi cultivating farms (67 q/ha) and they could able to realize higher gross returns from KRH-4 paddy (Rs. 140868) than from Meenakshi (Rs. 125265). Consequently, net return from KRH-4 paddy cultivation was more (Rs. 61853) compared to Meenakshi (Rs. 48445). This higher return from KRH-4 cultivation was due to higher yield level. These results are in line with Hamsa *et al*. 2018 [6].

The returns per rupee of expenditure from KRH-4 and Meenakshi were Rs. 1.74 and Rs. 1.57, respectively. This indicated that, every rupee spent in cultivation of KRH-4 and Control variety gave a net return of Rs.0.74 and Rs. 0.57, respectively. The cost of production was comparatively less for KRH-4 (Rs. 1086) compared to control variety (Rs. 1156), thus farmers growing KRH-4 were found more efficient. These findings are in line with the study conducted by Raghupathi *et al.* (2021) [7] on economic impact of Arka Sharath French bean variety, which revealed that, the per acre gross returns realized by the Arka Sharath French bean variety (Rs. 2,62,500) was 29 per cent higher (Rs. 7,7510) than check variety Ashoka (Rs. 1,84,990) in Karnataka

**Table 3:** Production and returns from KRH-4 and Meenakshi varieties of paddy in the study area (Per ha)

| Sl. No | Particulars | KRH-4 | | | Meenakshi (Check) | | |
|---|---|---|---|---|---|---|---|
| **I** | **Returns** | **Quantity** | **Price (Rs.)** | **Returns (Rs.)** | **Quantity** | **Price (Rs.)** | **Returns (Rs.)** |
| 1 | Main product (q) | 74.50 | 1740 | 129630 | 67.00 | 1710 | 114570 |
| 2 | By-product (q) | 36.25 | 310 | 11238 | 34.50 | 310 | 10695 |
| 3 | Gross returns (₹) | 140868 | | | 125265 | | |
| 4 | Net returns (₹) | 61853 | | | 48445 | | |
| II | Returns per rupee of expenditure (₹) | 1.78 | | | 1.63 | | |
| III | Cost of production (₹/q) | 1061 | | | 1147 | | |

**Comparative benefit of KRH-4 over Meenakshi in paddy production**

Partial budgeting technique was used to estimate the advantage of UASB released cultivar (KRH-4) over the check (Meenakshi) in terms of additional output and gain in net income of farmers from paddy cultivation. It is evident from Table 4 that, the farmers growing KRH-4 paddy had realized a net gain of Rs. 13519.25 per hectare over farmers growing control variety. The net gain consisted of income due to higher yield (Rs. 15603/ha) and saving in the expenses (Rs.2768/ha) on seeds, Bullock labour, fertilizer and PPC, The higher difference in per hectare gross returns (Rs. 18371/ha) between the two hybrids chosen for comparison were offset to the extent of Rs.4851.25, as the KRH-4 variety cultivating farmers spent higher expenses than Meenakshi on inputs like Human labour (Rs.2000), FYM (Rs.900), Machine labour (Rs1125), irrigation (Rs.800), including the imputed value of research and extension cost of Rs.26.25 per hectare. Thus, the cultivation of KRH-4 paddy has given higher yield level and higher net income indicating the advantage and profitableness of KRH-4 paddy. These results are on par with the study conducted by Pramod and Mahadevaiah (2021) [8] who reported that, the farmers growing improved redgram variety (BRG-2) have realized net gain of Rs. 5780 over the check variety.

**Table 4:** Relative benefit of KRH-4 variety over Meenakshi in paddy production (Rs/ha)

| Debit | | Amount (Rs) | Credit | | Amount (Rs) |
|---|---|---|---|---|---|
| **A** | **Increase in cost due to KRH-4 variety** | | **C** | **Decrease in cost due to KRH-4 variety** | |
| i | Human labour | 2000 | i | Seed cost | 455 |
| ii | Tractor (Hrs) | 1125 | ii | Bullock labour | 1520 |
| iii | Irrigation | 800 | iii | Fertilizer | 653 |
| iv | FYM | 900 | iv | PPC | 140 |
| vi | Research and extension costs | 26.25 | | | |
| B | Decrease in returns due to KRH-4 variety | 00 | D | Increase in returns due to KRH-4 variety | 15603 |
| | Total debits | 4851.25 | | Total credits | 18371 |
| | Net gain (Rs. /ha) = (Total credits -Total debits) = Rs. 13519.25 | | | | |

The threshold output of sugarcane was 0.987 quintals per farm which is the level of paddy output due to the factors which are not included in the regression model. The regression coefficient for human labour was 0.140 and was highly significant at one per cent level of probability, indicating that for one per cent increase in usage of human labour from its existing geometric mean level, the output would increase by 0.140 per cent from its geometric mean level. The regression coefficient of seed material was 0.434 and was statistically significant at one per cent level of probability implying for every per cent increase in the use of seed material from its geometric mean level, the output increase by 0.434 per cent from its present level. The production coefficient for FYM (0.111) was statistically significant at five per cent level of probability. Rest of the inputs like machine labour, bullock labour, fertilizer and PPC inputs exhibited positive relation with level of output but fail to exert any significance influence on paddy production.

**Table 5:** Impact of KRH-4 on paddy yield in study area (Dependent Variable: Yield in quintals)

| Sl. No | Particulars | Coefficients | t Stat |
|---|---|---|---|
| | **N (Sample size)** | **100** | |
| 1 | Intercept | 0.987*** | 4.829 |
| 2 | Human labour (Man days) | 0.140*** | 3.451 |
| 3 | Machine labour (Hours) | 0.050 | 1.509 |
| 4 | Bullock Labour (Pair days) | 0.041 | 1.208 |
| 5 | Seed (Kg) | 0.434*** | 10.062 |
| 6 | Fertilizer (Rs.) | 0.037 | 1.3201 |
| 7 | FYM (Tractor Load) | 0.111** | 2.360 |
| 8 | PPC (Rs.) | 0.022 | 1.316 |
| 9 | D (1=KRH-4 variety, otherwise 0) | 0.166*** | 5.869 |
| 10 | Returns to scale (∑bi) | 1.01 | |
| 11 | Coefficient of multiple determination ($R^2$) | | 0.826 |
| 12 | Adjusted $R^2$ | | 0.792 |
| 13 | F value | | 24.27*** |

**Note:** ***, **and * indicates significance at one, five and ten per cent, respectively

Because of adoption of new varietal technology (KRH-4) the threshold yield level of KRH-4 paddy has increased by 0.166 quintals per farm as revealed by the significant coefficient for dummy variable used for KRH-4 paddy growing farms in the study area (Table 5). Therefore, adoption of UASB released KRH-4 paddy showed significantly higher productivity than on farms growing Meenakshi.

## Conclusion

The farmers cultivating UASB paddy (KRH-4 hybrid) have realized higher yield of 11.20 per cent and gained higher returns compared to farmers cultivating check. Therefore, the Department of Agriculture, Government of Karnataka and UAS-B can make intensive efforts to popularize and encourage the widespread adoption of KRH-4 paddy to realize full potential of the crop productivity and to augment farm income.

## References


1. Cohen, Joel E. Choosing Future Population. Nature Transformed. National Humanities Center; c2009. http://nationalhumanitiescenter.org/tserve/nattrans/ntuseland/essays/population.htm.
2. Anonymous, The future of food and agriculture – Alternative pathways to 2050. FAO, Rome. 2018;10:228.
3. www.indiastat.com
4. Food corporation of India, Annual Report (2021-22). State Wise Procurement of Rice; c2022. https://fci.gov.in/app/webroot/upload/Procurement/2.%20paddy%20proc.%2010%20yrs%20(2)_6.pdf.
5. Statista research department, Production volume of food grains in India; c2021; https://www.statista.com/statistics/1140261/india-production-volume-of-food-grains/.
6. Hamsa KR, Umesh KB, Veerabhadrappa Bellundagi, Gururaj B. Economic surplus approach for impact assessment of soil reviving programme in Karnataka: An economic analysis. Current Journal of Applied Science and Technology. 2018;30(5):1-13.
7. Raghupathi R, Mahadevaiah GS. Impact of technological innovation in French bean and China aster on farmer's income in Karnataka: An economic analysis. Mysore J Agric. Sci. 2021;55(2):124.
8. Pramod, Mahadevaiah GS. Impact of action research project on livelihood security in disadvantaged districts of Karnataka: A case of livelihood development project under NAIP in Chitradurga district. Mysore J Agric. Sci. 2021;55(1):94.