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Economic analysis of impact of farm pond on productivity of inputs used in crop production

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Abstract
Economic evaluation of farm pond is necessary for the effective implementation. The main objective of present study was to assess the impact of farm ponds on productivity of various inputs used by farmers. This study was undertaken in Akola tahasil. The study was based on a sample of 60 beneficiary and 60 non-beneficiary farmers data pertaining the year 2017-18 were collected by survey method from the beneficiary and non-beneficiary farmers. The sample farmers were personally contacted and primary data was collected. In this study it is concluded that input factor on beneficiary farms indicate higher input productivity on beneficiary farmers.

Keywords: Farm pond, productivity, Akola, Tahasil

Introduction
Ground water availability is poor in many areas due to absence of aquifers and occurrence of hard rock lower layers. Farm pond is helpful in ground water recharge. Farm pond is believed to be better cost effective as compared to large scale canal irrigation. The farm ponds are water harvesting structures used for several purposes of farm need, farm pond is used for storing the monsoon rain water, which is used for irrigation. A farm pond has found significant in the rainfed agriculture. Farm ponds are expected to have an impact on technological change, economical change and social change of the farmers.

Farm ponds are small water harvesting structure used for collection and storing runoff water. Farm ponds are constructed with varying size and may fulfilled several farm needs such as supply of the water to crops. Farm ponds can also supply a water source for frost protection, recharge groundwater and provide a wide range of additional economic and environmental benefits.

The present study will be helpful to know the use of farm ponds in the agricultural development and with a need to know its impact specially in Akola tahasil of Vidarbha region. The ground water level is also in depth. Therefore, farm pond is an important source of irrigation in this area to study the impact of farm ponds on the productivity of various inputs used in crop production.

Material and Method
Selection of Sample
Akola tahasil covers 174 villages. Out of these 5 villages were selected for present study namely Ghusar, Agar, Gandhigram, Dahihanda, Hingni Bk. These villages were purposively selected and taking into consideration, availability of at least twelve farm ponds in each village and their accessibility. List of farm pond beneficiary farmers from these villages was prepared with the help of officials of the State Department of Agriculture who are stationed at Akola tahasil. In all 60 beneficiary and 60 non-beneficiary farmers were selected for the study by selecting12 beneficiary and 12 non-beneficiary farmers from each village. The sample farmers were personally contacted and primary data for the year 2017-18 was collected from them in a specially structured schedule.

Production function analysis
To examine the impact of farm pond activity and productivity of various inputs the production function analysis was used; per farm production function of the following type was estimated for this purpose.

$Y = ax_1^{b1} x_2^{b2} x_3^{b3} x_4^{b4} x_5^{b5}$

The above production function was be converted into linear form as follows:

$\text{Log } Y = \text{Log } a + b_1 \log x_1 + b_2 \text{ Log } x_2 + b_3 \text{ Log } x_3 + b_4 \text{ Log } x_4 + b_5 \log x_5$

Where,
Y = Gross income in Rs. per farm.
X_1 = Land area in hectares per farm.
X_2 = Human labour in days per farm.
X_3 = Bullock labour in days per farm.
X_4 = Expenditure on manure and fertilizer in Rs. per farm.
X_5 = Working capital in Rs. per farm.
a = Intercept.
b_1 to b_5 = Regression coefficient of the concerned factors.

Estimation of MVP

The impact of farm pond availability or non-availability on factor productivity was examined through estimated marginal value products (MVP) of the factor inputs. MVP was calculated as under:

$$MVP = b_i \frac{Y}{Xi}$$

Where,
Y is the estimated output when all the inputs (x`s) are held at their geometric mean level, `b_i is the regression coefficient of the concerned input factor and `$X_i$ is the geometric mean of the i`th factor.

Results and Discussion

Production function analysis

The present study was undertaken to study the impact of farm pond on productivity of inputs used in crop production and the results are presented in table 1.

Table 1: Production function estimates for beneficiary and non-beneficiary farms

Sr. No.	Input	Regression coefficient							
		Small		Medium		Large		Overall	
		B	NB	B	NB	B	NB	B	NB
1	Intercept	2.94	2.65	0.9	2.56	3.55	4.47	2.46	3.23
		(0.43)	(0.45)	(0.01)	(0.40)	(0.51)	(0.65)	(0.31)	(0.50)
2	Land (X_1)	0.74**	0.51**	0.72	0.69**	0.49**	0.42	0.65**	0.54**
		(0.19)	(0.23)	(0.41)	(0.32)	(0.10)	(0.59)	(0.23)	(0.38)
3	Human labour (X_2)	0.23	0.35**	0.37	0.22	0.12	0.09	0.24	0.22
		(0.22)	(0.21)	(0.47)	(0.27)	(0.50)	(0.55)	(0.40)	(0.34)
4	Bullock labour (X_3)	0.07	0.05	0.09	-0.04	-0.071	0.02	0.03	0.01
		(0.15)	(0.10)	(0.31)	(0.24)	(0.34)	(0.91)	(0.27)	(0.35)
5	Manures and fertilizers (X_4)	0.23**	0.22	0.3	0.27	0.21**	0.15	0.25**	0.21
		(0.05)	(0.09)	(0.28)	(0.61)	(1.02)	(0.09)	(0.45)	(0.26)
6	Working capital (X_5)	0.53**	0.4**	0.57**	0.49	0.58**	0.44	0.56*	0.44
		(0.09)	(0.06)	(0.12)	(0.08)	(0.13)	(0.09)	(0.11)	(0.04)
	R^2	0.79	0.59	0.84	0.63	0.83	0.61	0.82	0.61

Note: *, ** indicates figures significant at 1 per cent and 5 per cent level of significance respectively.

It could be seen from table that the R^2 value for beneficiary and non-beneficiary group was 0.82 and 0.61 respectively. At overall level regression coefficient of land in beneficiary category was 0.65 against 0.54 for non-beneficiary category. Regression coefficient of manures and fertilizers for beneficiary and non-beneficiary farm was 0.25 and 0.21 respectively. For working capital the regression coefficient for beneficiary group at overall level was 0.56 as against 0.44 for the non-beneficiary group. Thus the regression coefficients which indicate the productivity of inputs factors were in general, higher for the beneficiary farms than the non-beneficiary category.

Higher regression coefficient and consequently the higher factor productivity for beneficiary farms were obviously due to farm pond availability on these farms. Farm pond availability ultimately made more water available for irrigation on beneficiary farms which resulted in increasing the productivity of land, manures and fertilizers which directly affect the crop yield.

Intergroup comparison revealed that the regression coefficients of land, manures and fertilizers and working capital for small category of farm in beneficiary groups were higher than the non-beneficiary groups. Same trend was seen in case of medium group of farmers. For large group of beneficiary category the regression coefficient of land, manures and fertilizers and working capital were higher than the large farms of non-beneficiary category. The study thus reveals that the productivity of the input factors on farms of the beneficiary group was higher than the non-beneficiary group. Thus, farm pond availability has resulted in increasing factor productivity on beneficiary farms. This finding has been proved in table 1.

Table 2: Marginal value products of input

Sr. No.	Factor	Beneficiary	Non-beneficiary
1	Land	12485.64	9107.81
2	Human labour	0.55	0.44
3	Bullock labour	0.38	0.12
4	Fertilizers and manures	2.26	1.62
5	Working capital	0.64	0.46

It could be seen from table 2 that the marginal value product (MVP) of land, bullock labour, manures and fertilizers and working capital at overall level of beneficiary farms was higher than non-beneficiary farms. This higher (MVP) of input factors on beneficiary farms indicate higher input productivity on this farm.

Conclusions

The regression coefficients which indicate the productivity of inputs factors were in general, higher for the beneficiary farms than the non-beneficiary category. Study revealed that the productivity of the input factors on farms of the beneficiary group was higher than the non-beneficiary group.

Thus, farm pond availability has resulted in increasing factor productivity on beneficiary farms. Marginal value product (MVP) of land, bullock labour, manures and fertilizers and working capital at overall level of beneficiary farms was higher than non- beneficiary farms. This higher (MVP) of input factors on beneficiary farms indicate higher input productivity on these farms.

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