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Use Of Hyv Seeds And Modern Implements And Its Impact On Cropping Intensity- A Case Study In The District Of Burdwan Of West Bengal

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Abstract: *No significant economic breakthrough is possible in a labour-surplus economy like India without transformation of its agricultural sector. The transformation should take place in two very important factors which are quite interdependent e.g. technological and institutional. These two being interdependent, a deliberate change in either of them independently will not bring forth any lasting effect on agricultural productivity. Accordingly, simultaneous change has to be introduced both in the prevailing technology and reforms in different institutional factors operating in the economy for the purpose of rapid agricultural growth. In this process technological change, which is embodied in capital and knowledge inputs, would play a major role. Moreover, irrigation, fertilizer and high yielding varieties are the most important factors that emanate the technological change and have major influence on the productivity of land. In this paper we try to examine the issues related to land size, irrigation facilities, HYV seeds and expenses on modern implements including tractorisation etc. among the factors for promoting cropping intensity which are the strongest force in promoting cropping intensity.*

Key Words:- *Productivity, Cropping-intensity, Certain-irrigated area, Gross cropped area, Chemical fertilizer, Land-size*

I. Introduction:

We know that progressive agriculture will demand various agricultural inputs, like irrigation, better seeds, better manures and fertilizers, use of mechanization, soil conservation, plant protection etc. Among these variables, three important factors affecting cropping intensity are mechanization, irrigation and farm size. But in case of mechanization, tractorisation is considered as one of the most important constituents. While the mechanization of agriculture has some validity in the context of the need to raise agricultural production as fast as possible within the shortest possible time, the case against mechanization is very much stronger. Rao[1] observes that tractorisation does not have a significant effect on cropping intensity. Whatever positive effect tractorisation has in promoting cropping intensity, will be offset, at least partly, by its high social cost. In fact, we do not usually consider social cost in this study in determining the value of any crop.

Another important variable, i.e. irrigation, is indispensable to agricultural production. H Kaneda[2] argues in the context of Pakistan that irrigation is the most important constraint on cropping intensity irrespective of whether tractors are used or not. It would, therefore, be worth understanding the order of importance of irrigation, expenses on modern implements and high yielding varieties in influencing the productivities of crops among the regions.

In these circumstances the specific objective of the study is to analyze among the factors for promoting cropping intensity which are the strongest force in promoting cropping intensity.

II. Materials and Methods:

Data Source:

There are six sub-divisions in Burdwan district. Among the sub-divisions, the people of two sub-divisions viz. Asansol and Durgapur are highly engaged in industrial activities. Our study is mainly concerned with agricultural activities. For this reason these two subdivisions have not been considered for the study. As these two sub-divisions have been left out, the study mainly concerns with remaining four sub-divisions. Survey work of the study has been carried out with primary data pertaining to four villages from remaining four sub-divisions taking one each from one sub-division. The field level information has been collected from the respondent farmers during the agricultural years 2004-2005 and 2005-2006. The survey aims at collection of all relevant information relating to farming activities of respondent farmers e.g. size of holdings, quality and quantity of seeds, total expenditure on seeds, area under HYV, cost of various types of fertilizers used, sources

of irrigation, expenditure in irrigation, nature of machinery used and expenditure related to their use, loan taken from formal and informal sources, interest on loan, loan advances to workers, storage cost, crop-hoarding period, crop-shrinkage, marketing facilities, transportation cost, types of crops cultivated by the respondent farmers and proportion of area cultivated under each crop and different crops cultivated by the respondent farmers in the recent past including proportion of area under each crop cultivation etc. We have also collected sale price and quantity sold of different crops separately from each respondent farmer.

Brief profile of the sample villages and the respondent families:

According to 2001 Census, there are 2438 villages in the district of Burdwan. But to make a comprehensive and in-depth of the problems for this empirical work, we have taken a sample of only four villages of different characteristics. Considering easy accessibility and familiarity with the farmers, these four villages have been selected purposively. These are Nashigram, Kashiyara, Hapania and Chhoto-Maliha. The administrative set-up, economy and communication of the selected villages are shown in the table 1. The village Nashigram is under Sadar(N) sub-division. The economy of the village is good with well communicated to the headquarters and other commercial places. The village Kashiyara under Sadar(S) sub-division is a village whose economy is good but communication is bad. The village Hapania is under Kalna sub-division having bad economic condition but communication of this village is good. The village Chhoto-Maliha under Katwa sub-division is a village whose economy is bad as well as communication is bad. We have taken equal number of respondent farmers from all the sample villages for the study i.e. out of total 200 farmer-families (table 2). 50 farmers from village Nasigram of Sadar (North) sub-division, another 50 farmers from village Kashiyara of Sadar (South) sub-division, 50 farmers from village Hapania located within Kalna sub-division and 50 farmers from village Chhoto-Maliha of Katwa sub-division. We have taken different categories of farmers randomly from the sample villages. Table 2 clearly shows the number of marginal, small, semi-medium, medium and large farmers of the four selected villages separately. Farmer families have been classified into five categories on the basis of land holdings. These are as follows: -

(1) Marginal: - Who have lands varying from below 1(one) acre,
(2) Small: - Who possesses lands varying from 1 acre to below 2 acres,
(3) Semi-Medium: - Who have own land between 2 acres to below 5 acres,
(4) Medium: - Who have lands having from 5 acres to below 10 acres,
(5) Large: - Who have 10 acres and above land.

Methodology:

For computation of acquired data, several prevalent statistical techniques have been applied. Tables and charts, linear regression equations etc. have extensively been used as and when required in analyzing data. In order to find out the relation between a) percentage of certain-irrigated area and cropping intensity and b) expenses on modern implements to total implements (Modern and Traditional) per unit of land and cropping intensity, we have done two variables linear regression equation only where we have taken y_1 as dependent variables and x as the independ variable. We have calculated the values of regression coefficient and summarized them in tables 3, 8, 9 and 10.

III. Result and Discussion:

The issue of use of HYV seeds and modern implements and its impact on cropping intensity is very important at present and to assess the role we begin by analyzing table 3. Table 3 presents two variable linear regression results showing the relation between Certain-irrigated areas as a percentage of GCA (Gross Cropped Area) and Cropping Intensity of the respondent farmers in the sample villages. From the table it is observed that the regression coefficient is positive in all the sample villages implying that there is a direct relationship between Certain-irrigated area and Cropping Intensity. Cropping intensity among the sample villages are compared on the basis of the data stated in table 3. It revealed from the said information that cropping indices are consistently and significantly higher in the villages Kashiyara and Hapania where certain irrigation facilities are easily available. Certain irrigation facilities, we mean irrigation water, is ensured and provided in any condition.

The calculated value of correlation coefficient (r) for Nashigram is 0.541849, which is the highest value among our sample villages. The second highest r-value of 0.53507 is noted for the village Chhoto-Maliha. It transpires from the above discussion that in these two villages, namely Nashigram and Chhoto-Maliha, the value of "r" is higher than the remaining two villages, meaning that as better irrigation facilities are provided, the cropping intensity is high in these two villages. On the other hand, the value of correlation coefficient for the villages Kashiyara and Hapania are 0.063246 and 0.037417 which are significantly low when compared with Nashigram and Chhoto-Maliha, meaning that the value of r depends on other factors of production because there is no upward or downward chance in supply irrigation water as they are consumed under cent percent (100 per

cent) certain irrigation facilities in these two villages. It is observed from the table 3 that the average size of holdings in the village Hapania is 2.039 acres which is lower than 4.603 acres of the village Kashiyara. It is also revealed from the table that the differences in certain irrigation facilities of these two villages are not being significant but the difference in cropping intensity is quite significant. Again, it is noted from the table 3 that the area under HYV crops in case of village Nashigram is higher (84.57) but the expenses for HYV seeds per acre is Rs.279.35. On the other hand, the village Kashiyara having the second highest area under HYV seeds (81.76) registers the highest (Rs.1738.58) expenses for HYV seeds per acre among our sample villages.

Table 4, 5, 6 and 7 depict the economic conditions of the selected respondent farmers in our study area. We know that HYV crops have shorter life span. These short duration crops thereby enable the farmers to go for cropping intensity. HYV crops are very costly and poor economic condition of our respondent farmers of the village Hapania restrains (table 6) them from adopting HYV crops. Therefore, it appears from the above discussion that HYV seeds have a more favourable impact on cropping intensity in the village Kashiyara than the village Hapania. However, economic condition influences the use of HYV seeds, which, in turn, affected the cropping intensity.

On the other hand, table-4 presents two variable linear regression results showing the relation between Certain-irrigated areas as a percentage of GCA and Cropping Intensity of the respondent farmers of different size groups in the sample villages taking all villages together. From the table- 4 it may be noted that the highest value of correlation coefficient ('r') of 0.879488 is recorded for large farmers and the second highest value of 'r' is 0.868562 related to medium farmers. But the value of MCI is higher of 1.9936 for marginal farms and the value of MCI which is the second highest (1.962) related to small farmers among all the respondent farmers in the sample villages. Furthermore, the areas under HYV seeds and the expenses on HYV seeds per acre of land are also lower for marginal and small farms than that of the medium farms. It is also revealed from the table that the size of holdings and the value of regression co-efficient ('r') between Certain-irrigated areas and Cropping Intensity for semi-medium group is higher than that of the small farms, but MCI is low in case of semi-medium groups. It is further revealed that the percentage of area under HYV crops and the expenses on HYV seeds per acre of land are also low for semi-medium group than any other size groups in our sample. Thus it is found from the above discussion that among the important determinants of cropping intensity, e.g. expenses on HYV seeds per acre of land, irrigation and farm size, the farm size is most important because it provides the strongest force in promoting cropping intensity.

Table- 5 provides us the two variable linear regression results showing the relation between the percentage of Expenses on Modern Implements to Total Expenses on Implements (Modern and Traditional) per unit of Land and Cropping Intensity of the respondent farmers in the sample villages. We observed that the regression coefficient is positive implying that there is a direct relationship between the Expenses on Modern Implements to Total Expenses on Implements per unit of Land and Cropping Intensity. Here we observe that the value of r is higher (0.313688) for Nashigram but MCI (2.356) and the expenses on modern implements per acre of land are higher (Rs. 1165.41) for the village Kashiyara.

Table-6 presents the linear regression results showing the relation between percentage of Expenses on Modern Implements to Total Expenses on Implements (Modern and Traditional) per unit of Land and Cropping Intensity of the respondent farmers of different size groups taking all villages together. Here we observed that there is a direct relationship between the two variables. It is observed from table 8 that the value of 'r' is higher (0.498096) for the respondent farmers of medium groups but the expenses on modern implements per acre of land is higher (Rs 789.16) for the respondent farmers of large size groups. But the value of MCI is the highest (1.9936) for the marginal farms among all the respondent farmers in the sample villages. By examining the tables 9 and table 10 it can be said that Expenses on Modern Implements to Total Expenses on Implements (Modern and Traditional) per unit of Land does not have any significant effect on Cropping Intensity. Thus, it can be asserted that marginal farms will be powerful instrument for enhancing productivity of land as the intensity of land use could be better for the marginal farmers than by the large farmers who usually makes huge investment in modern implements, more specifically in tractors in promoting cropping intensity. Therefore, expenses on modern implements per acre of land particularly, expenses on tractorization is neither necessary nor as a condition of high level of cropping intensity. The difficulty in timely preparation of land will be greater as the farm size becomes larger and to resolve this difficulty the large farm may adopt tractors. But emphasis should be given on the small and marginal farms for increasing the cropping intensity and productivity of land.

IV. Conclusion:

It can be concluded from the preceding discussion that among the important determinants of cropping intensity, e.g. expenses on modern implements, expenses on HYV seeds per acre of land, irrigation facilities and farm size; the farm size is most important in the sense it provides the strongest force in promoting cropping intensity. It is revealed from our study that HYV seeds have a more favourable impact on cropping intensity. The short duration HYV seeds enable the farmers to go for cropping intensity. It is also revealed from our study

that poor economic condition restrains the farmers from adopting HYV seeds which in turn affected cropping intensity. Again, expenses on modern implements, expenses on tractors and irrigation, we have noted, contribute positive impact on cropping intensity.

It can be asserted from the findings of the study that marginal farms will be powerful instrument for enhancing productivity of land as the intensity of land use could be better for the marginal farmers than the big farmers who usually make large investment in modern implements, more specifically in tractors and other mechanical devices in promoting cropping intensity. Therefore, expenses on modern implements per acre of land particularly in tractorization expenses is neither necessary nor as a condition of high level of cropping intensity. Difficulty in timely preparation of land will be greater as the farm size becomes larger and larger and to resolve this difficulty the large farm may adopt tractors. But emphasis should be given on the small and marginal farms for increasing the cropping intensity and productivity of land. It is observed in this study that cropping intensity as well as physical productivity per acre of land (Table 11) is better in case of small and marginal farmers. We, therefore, discard large scale farming and support intensive small scale farming. It will not only enhance production but also increases the scope of employment.

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Table 1: Administrative Set up, Socio Economic Condition and Communication of the sample villages (Source: Field Survey.)

Descriptions	Nashigram	Kashiyara	Hapania	Chhoto-Maliha
District	Burdwan	Burdwan	Burdwan	Burdwan
Sub-Division	Sadar North	Sadar South	Kalna	Katwa
Block	Bhatar	Memari-I	Purbasthali-II	Ketugram - II
Panchayet	Barbaloon-II	Gope-gantar-II	Pila	Billeswar
Economy	Good	Good	Bad	Bad
Communication	Good	Bad	Good	Bad

Table 2: No of Marginal, Small, Simi-Medium, Medium and Large farmers of the sample villages (Source: Field Survey.)

Descriptions	Marginal	Small	Semi-medium	Medium	Large	Total
Nashigram	9	7	9	11	14	50
Kashiyara	3	12	10	20	5	50
Hapania	12	12	19	7	0	50
Chhoto-Maliha	7	12	17	12	2	50
Total	31	43	55	50	21	200

Table 3: Linear regression results showing the relation between Percentage of Certain-irrigated area and Cropping Intensity (Source: - Field Survey)

Villages	Nashigram	Kashiyara	Hapania	Chhoto-Maliha
No. of Respondents	50	50	50	50
% of (truly) certain- irrigated land	53.33	97.29	99.71	22.31
Average Multiple Cropping Index	1.63	2.365	2.092	1.451
Average Size of Holdings	7.436	4.603	2.039	3.64
% of GCA	84.57	81.76	65.68	73.5

under HYV crops*				
Expenses on HYV seeds per Acre of Land	279.35	1738.58	461.78	70.16
Intercept	131.78	159.09	129.96	134.94
Slope	(+) 0.601	(+) 0.844	(+) 3.498	(+) 0.740
R^2	0.2936	0.004	0.0014	0.2863
r	(+) .5418	(+) 0.0632	(+) 0.0374	(+) 0.5350

*Expenses on HYV seeds per Acre of Land = Total Exp. On HYV/GCA

Table 4: Occupational pattern of the respondent families in Nashigram (Source: Field Survey)

Description	Population size	Service	Business	Others	Agriculture	Dependents	Av. Income Per head other than Ag.(yr.)
Marginal	37(11.81)	0	0	0	9 (2.72)	28 (8.45)	878
Small	43 (12.99)	0	0	1(0.32)	8 (2.42)	34 (10.27)	718
Semi - medium	75 (22.66)	0	1(0.30)	4 (1.21)	13 (3.93)	57 (17.22)	1600
Medium	62 (18.73)	3 (0.91)	0	0	18 (5.44)	41(12.39)	9645
Large	114 (34.44)	24 (7.25)	15 (4.53)	2 (0.60)	10 (3.02)	63(19.03)	74956
Total	331 (100)	27 (8.15)	16 (4.84)	7 (2.11)	58 (17.53)	223 (67.37)	28174

*Note: "0" means not found; Figures in the parentheses are percentages.

Table 5: Occupational pattern of the respondent families in Kashiyara (Source: Field Survey)

Description	Population size	Service	Business	Others	Agriculture	Dependents	Av. Income Per head other than Ag.(yr.)
Marginal	12(4.44)	0	0	0	3 (1.11)	9 (3.33)	1313
Small	53 (19.62)	0	0	1(0.37)	15 (5.56)	37 (13.7)	2150
Semi-medium	56 (20.74)	0	1 (0.37)	4 (1.48)	15 (5.56)	36 (13.33)	3107
Medium	119 (44.07)	3 (1.11)	3 (1.11)	6 (2.22)	36 (13.33)	71 (26.30)	7192
Large	30 (11.11)	0	2 (0.74)	0	9 (3.33)	19 (7.0)	1500
Total	270 (100)	3 (1.11)	6 (2.22)	11 (4.08)	78 (28.89)	172 (63.70)	4462

*Note: "0" means not found; Figures in the parentheses are percentages.

Table 6: Occupational pattern of the respondent families in Hapania (Source: Field Survey)

Description	Population size	Service	Business	Others	Agriculture	Dependents	Av. Income Per head other than Ag.(yr.)
Marginal	52 (21.22)	0	0	9(3.67)	12 (4.89)	31 (12.65)	3238
Small	54 (22.04)	0	1 (0.41)	3(1.22)	16 (6.53)	34 (13.88)	1528
Semi-medium	91(37.14)	0	1(0.41)	7(2.85)	30 (12.24)	53 (21.63)	3407
Medium	48 (19.59)	0	3 (1.22)	1(0.41)	17 (6.94)	27(11.02)	1750
Large	0	0	0	0	0	0	0
Total	245 (100)	0	5 (2.04)	20 (8.16)	75 (30.62)	145 (59.18)	2510

Note: "0" means not found; Figures in the parentheses are percentages.

Table 7: Occupational pattern of the respondent families in Chhoto-Maliha (Source: Field Survey)

Description	Population size	Service	Business	Others	Agriculture	Dependents	Av. Income Per head other than Ag.(yr.)
Marginal	24 (9.16)	0	0	4 (1.53)	8 (3.05)	12 (4.58)	6000
Small	50 (19.08)	0	0	2 (0.76)	16 (6.11)	32 (12.21)	804
Semi-medium	68 (25.95)	0	1 (0.38)	3 (1.15)	23 (8.78)	41(15.65)	302
Medium	97 (37.02)	6 2.29)	3 (1.15)	1(0.38)	16 (6.11)	71(27.09)	9559
Large	23 (8.78)	0	2 (0.76)	0	4 (1.53)	17(6.49)	15217
Total	262 (100)	6 2.29)	6 (2.29)	10 (3.82)	67 (25.57)	173 (66.03)	6190

Note: "0" means not found; Figures in the parentheses are percentages.

Table 8: Regression results showing the relation between Percentage of Certain-irrigated areas and cropping intensity of the respondent farmers in the sample villages taking all villages together (Source: Field Survey.)

.Group	Marginal	Small	Semi- Medium	Medium	Large
No. of respondents	31	43	55	50	21
% of (truly) certain-irrigated land	72.49	66.37	70.3	67.4	56.94
Average Multiple Cropping Index	1.9936	1.962	1.8884	1.8868	1.7539
Average Size of Holdings	0.609	1.359	2.577	5.76	18.038
% of GCA under HYV crops	50.37	53.76	16.02	70.96	91.92
Expenses on HYV seeds per Acre of Land*	708.81	686.32	187.09	1045.86	587.07
Intercept	149.85	123.28	104.62	118.58	111.53
Slope	(+)0.778	(+)1.139	(+)1.101	(+)1.095	(+)1.132
R^2	0.2448	0.5603	0.5752	0.7544	0.7735
r	(+)0.494	(+)0.748	(+)0.758	(+)0.868	(+) 0.879

*Expenses on HYV seeds per Acre of Land = Total Exp. On HYV/GCA

Result: In the sample villages the regression coefficient is positive implying that there is a direct relationship between Percentage of Certain-irrigated area and Cropping Intensity.

Table 9: Regression results showing the relation between Expenses on Modern Implements to Total implements (Modern and Traditional) per unit of Land and Cropping Intensity of the respondent farmers in sample villages.

Villages	Nashigram	Kashiyara	Hapania	Chhoto-Maliha
No. of Respondents	50	50	50	50
Average MCI	1.63	2.365	2.092	1.451
Average Size of Holdings	7.436	4.603	2.039	3.64
% of GCA under HYV crops	84.57	81.76	65.68	73.5
Expenses per Acre of Land*	625.77	1165.41	322.35	331.23
Intercept	1.5689	2.3401	1.5689	1.4495
Slope	(+) 0.2428	(+) 0.1052	(+) 0.2428	(+) 0.091
R^2	0.0984	0.0261	0.019	0.0056
r	(+) 0.313	(+) 0.161	(+) 0.137	(+) 0.074

Source: Field Survey.

*Expenses on Modern Implements per Acre of Land = Total Exp. On Modern Imp./GCA

Result: In the sample villages the regression coefficient is positive implying that there is a direct relationship between Expenses on Modern Implements to Total Expenses on Modern and Traditional Implements per unit of Land and Cropping Intensity.

Table 10: Regression showing the relation between Expenses on Modern Implements to Total Implements per unit of Land and Cropping Intensity of the respondent farmers in all the sample villages taking together.

Groups	Marginal	Small	Semi-Medium	Medium	Large
No. of respondents	31	43	55	50	21
Average MCI	1.9936	1.962	1.8884	1.8868	1.7539
Average Size of Holdings	1.9936	1.962	1.8884	1.8868	1.7539
% of GCA under HYV crops	50.37	53.76	16.02	70.96	91.92
Expenses on per Acre of land*	467.36	572.1	162.9	764.23	789.16
Intercept	1.8687	1.5682	1.8789	1.5283	1.3889
Slope	(+)0.1695	(+)0.8779	(+)0.1661	(+)2.9941	(+)7.7536
R^2	0.0745	0.2551	0.0036	0.2481	0.2171
r	(+) 0.272	(+) 0.505	(+) 0.06	(+) 0.498	(+) 0.465

Source: Field Survey.

*Expenses on Modern Implements per Acre of Land =Total Exp. on Modern Imp./GCA

Result: In the sample villages the regression coefficient is positive implying that there is a direct relationship between Expenses on Modern Implements to Total Expenses on Modern and Traditional Implements per unit of Land and Cropping Intensity.

Table 11: Overall Agricultural Performance of the respondent farmers in the sample villages (all crops taken together) for the Agricultural Year 2005-06 (Source: Field Survey).

Description	Nashigram	Kashiyara	Hapania	Chhoto-Maliha
Average Physical Productivity (in kgs.)	1722	4157	2254	1642
Average Effective Value Productivity (in Rs.)	11671	18942	11901	9830
MCI	1.630	2.365	2.092	1.451
Average Production Cost Per Acre (in Rs.)	9244	28067	15443	6274
Average Annual Net Profit Per Acre (in Rs.)	9850	16734	9473	8025