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Socio-economic impact of conservation agriculture technology in Jabalpur district of Madhya Pradesh

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Abstract
Conservation agriculture (CA) is an eco-friendly and resource saving approach of farming which restore soil fertility, improve moisture conservation, increase infiltration rate, improve soil organic carbon, micro-organism activity and reducing labor needs, that ensures increased crop productivity and reduces total cost of cultivation. The CA technology in Rice-Wheat cropping has significant impact in the Jabalpur district of Madhya Pradesh where sowing of wheat through conventional practices using tillage and mono cropping, resulted in reduction of yield. The survey of purposively selected 80 adopters and 80 non-adopters of CA has clearly established socio-cultural, psychological and economic gains by reflecting 13 and 15 per cent improvement in Rice and Wheat productivity respectively. Further, the scanning of socio-economic data indicated that CA had sense of achievement, merit for promotion, technical feasibility, stress reduction and opportunity for custom hiring services.

Keywords: Socio-economic, agriculture technology, Jabalpur

Introduction
Adoption of green revolution technologies during 1960s led to increased productivity and elimination of acute food grain shortages in India. These technologies primarily involved growing of high-yielding dwarf varieties of rice and wheat, increased use of chemical fertilizers and other agrochemicals, and spread of irrigation facilities. This was also accompanied by the other so called modern methods of cultivation, which included maximum tilling of land, virtually clean cultivation with complete removal of crop residues and other biomass from the field, fixed crop rotations mostly involving cereals, and elimination of fertility-restoring pulses and oilseed crops in the high productive north-western plain zone of the country. Continuous adoption of the green revolution technologies has resulted emerging concerns about natural resource degradation (DWR report, 2017) [1].

Thus, the concept of conservation agriculture has been developed to reverse the process of land degradation and ensure sustainable crop production, which involves three inter-related principles viz. (i) minimizing soil disturbance – no tillage and minimum traffic for agricultural operations, (ii) maximizing soil cover – leave and manage crop residues on soil surface; and (iii) stimulating biological activity through suitable crop rotations including use of cover crops, and green manures. Further, this requires a systems approach, i.e. efficient seeding machinery, nutrient, water, weed and pest management. This technology has been adopted globally on more than 125 M ha in about 50 countries, largely in rainfed areas. The major countries are; USA, Australia, Canada, Argentina, Brazil, Uruguay and New Zealand (Jat *et al.*, 2012) [2].

In India, this realization started in early 1990s when some experiments were initiated on zero-till wheat in north-western India, primarily through the efforts of IRRI, CIMMYT and world bank funded NATP. There was good success obtained in many states, and the area under zero-till wheat reached up to 3 M ha by the beginning of current century. However, the acreage have stagnated now and some farmers have even switched back to minimum or conventional systems because of some practical constraints and lack of technical know-how. There is a need to reorient our strategies to tackle these problems based on the knowledge gained in recent years and developments in the farm machinery sector. Accordingly, socio-economic impact of CA technology among adopters and non-adopters was studied in those clusters where farmers had adopted this innovative technology.

Materials and Methods
To the socio-economic impact of CA technology among adopters and non-adopters, present study was conducted in Jabalpur district of Madhya Pradesh, which comprises of 7 blocks, out

of which, four blocks namely Panagar, Patan, Shahpura and Sihora were selected purposively, as these are the only blocks, where CA technology is adopted by the farmers. 17 villages, adopting CA were selected and from each selected village, a total of 80 adopters and 80 non-adopters of CA were short-listed as respondents (Table 1). To determine socio-economic impact of CA technology among adopters and non-adopters the farmers were personally interviewed and data was collected with the help of pre-tested interview schedule The collected data were tabulated and presented in the form of tables and graphs and analysis was done by percentage, mean, standard deviation, and paired t-test to draw meaningful conclusion.

Table 1: Name of selected villages and number of respondents (CA adopters) from each selected village.

S. No.	Name of Block	Name of Village	Total no. of farmer practicing CA	No. of adopters of CA selected for study
1.	Panagar	(i) Bharda	17	17
		(ii) Imlai	14	14
		(iii) Raipura	10	10
		(iv) Mohaniya	6	6
		(v) Kariwah	5	0
		(vi) Kushner	2	0
		(vii) Bijhuwa	1	1
2.	Sihora	(i) khamariya	13	13
		(ii) Ghutna	4	4
		(iii) Muhatara	2	2
		(iv) Jhansi	2	2
3.	Patan	(i) Ponia	4	4
		(ii) Khera	1	1
		(iii) Ramkhiriya	1	1
4.	Shahpura	(i) Rosara	2	2
		(ii) Pindarai	2	2
		(iii) Sesra	1	1
	Total		88	80

[**Source:** ICAR-DWR, Jabalpur (MP)]

Results and Discussion

Socio-economic profile

The data recorded in Table 1.1 indicate age-wise distribution of sample farmers, showed that majority of adopters (71.25%) were in age group of 36-55 years followed by young age (18.75T). Above 55 years of age, only 10.00 per cent farmers adopted CA technology, which reflects that mature and younger farmers of the society are fast adopter and better decision makers in favour of innovative technology. The similar results were reported by Singh and Pandey (2004) [3].

Table 1.1: Distribution of adopters and non-adopters of CA according to age

S. No.	Age categories	Frequency		Percentage	
		A	NA	A	NA
1.	Young (upto 35 yr)	15	11	18.75	13.75
2.	Middle (36 – 55 yr)	57	40	71.25	50
3.	Old (above 55yr)	8	29	10.00	36.25
Total		80	80	100.00	100

A= Adopters, NA= Non-adopters

Table 2: Distribution of adopters and non- adopters according to Education

S. No	Education	Frequency		Percentage	
		A	NA	A	NA
1.	Illiterates	2	8	2.50	10.00
2.	Primary school education	6	7	7.50	8.75
3.	Middle school education	8	12	10.00	15.00
4.	High school education	20	19	25.00	23.75
5.	Higher secondary education	26	23	32.50	28.75
6.	College level education	18	11	22.50	13.75
	Total	80	20	100.00	100.00

A= Adopters, NA= Non-adopters

Education has significant correlation with adoption of new technology and thus, in the present study majority of adopters were formally educated (Table 2). 48.75 per cent of the adopters had 16 to 20 years of farming experience (Table 3) and 2.1 to 4 years of experience of practicing CA technology (Table 4) with no to low social participation (Table 5).

Table 3: Distribution of adopters according to farming experience

Categories	Frequency		Percentage	
	A	NA	A	NA
Up to 15 years	18	13	22.50	16.25
16 - 30 years	39	41	48.75	51.25
Above 30 years	23	26	28.75	32.50
Total	80	80	100.00	100.00

Table 4: Distribution of adopters and non-adopters according to experience of practicing CA

Categories	Frequency		Percentage	
	A	NA	A	NA
Up to 2 years	16	0	20.00	0
2.1-4 years	25	0	31.25	0
4.1-6 years	20	0	25.00	0
Above 6 years	19	0	23.75	0
Total	80		100.00	

Table 5: Distribution of adopters and non-adopters of CA according to social participation

S. No.	Categories	Frequency		Percentage	
		A	NA	A	NA
1.	No participation (0 scores)	17	26	21.25	32.5
2.	Low (1-5 score)	32	31	40.00	38.75
3.	Medium (6-10 score)	20	18	25.00	22.50
4.	High (1 and above score)	11	5	13.75	6.25
5.	Total	80	80	100.00	100

Higher percentage of adopters (40.00%), belonged to medium size of holding followed by 26.25 per cent and 23.75 per cent farmers belonged to small and large categories, respectively, Only 10 per cent of marginal farmers whose holdings were less than one hectare adopted this technology due to lack of machine, small size of holding and less risk bearing capacity (Table 6). Further, it was found that, 30.00 per cent of the adopters had 2.1-4 ha area under CA, followed by small (23.75%), large (17.50%) and marginal (6.25%) land holdings. Also, 22.50 per cent of farmers were practicing CA in .405 ha area, which shows that, CA is a feasible for small and marginal land holding farmers. (Table 7). But, CA technology is popular between medium and large farmers as they have largest plot sizes and they are capable of taking risk in the early phase of this technology. These findings are supported by Sinha and Singh (2001) [4].

Table 6: Distribution of adopters and non-adopters according to their size of land holding

S.No.	Categories	frequency		Percentage	
		A	NA	A	NA
1.	Marginal land holding (Up to 1 ha.)	8	20	10	25
2.	small land holding (1.1-2 ha)	21	30	26.25	37.50
3.	Medium land holding (2.1- 4 ha.)	32	21	40.00	26.25
4.	Large farmer (above 4 Ha.)	19	9	11.25	23.75
	Total	80	80	100.00	100.00

Table 7: Distribution of farmers according to their land under CA

S.No.	Categories	frequency	Percentage
1.	Upto .405 ha (i.e. 1 acre)	18	22.50
2.	Marginal land holding (Up to 1 ha.)	5	6.25
3.	small land holding (1.1-2 ha)	19	23.75
4.	Medium land holding (2.1- 4 ha.)	24	30.00
5.	Large farmer (above 4 ha.)	14	17.50
	Total	80	100

Economic characteristics

The adopters were not economically so rich as their farm implements possession was low. One third of the adopters (32.50%) has medium farm power, while 28.75 per cent ha d no farm power. Also, 40.00 per cent of adopters had medium implements with 28.75 per cent of them having nil. Among 80 adopters, happy seeder was possessed by only 4 farmers, and rest arranged their sowing either on custom hire basis or used the machine provided by university for demonstration purpose or by Zero-till seed drill (Table 8 and 9). Thus, we can conclude that, large farmers who are economically somewhat sound adopted technology fast and in higher percentage when compared to medium assets owner. Sizable percentage of the adopters (32.50) followed Rice-Wheat-moong/Urd cropping system. Inspite of being a third principle of CA of including a leguminous crop in crop rotation, due to the problem of grazing by cattle and unavailability of fencing, the percentage of taking a third crops as a leguminous crop in zaid was very less in both the categories (Table 10).

Further, it was found that. 43.75 per cent had medium income ranging from 1,65001-2,30,000, while none of the adopters had very low income, which proves that, CA is the profitable technology. (Table 11)

Table 8: Distribution of farmers according to their farm power

S. No.	Categories	frequency		Percentage	
		A	NA	A	NA
1.	No farm power (0 score)	23	30	28.75	37.50
2.	Low farm power (5-8)	19	28	23.75	35.00
3.	Medium farm power (6-10)	26	14	32.50	17.50
4.	High farm power (9-12)	12	8	15.00	10.00
	Total	80	80	100	100

Table 9: Distribution of farmers according to their implements possesion

S. No.	Implements	frequency		Percentage	
1.	No farm power (0 score)	23	30	28.75	37.50
2.	Low (1-5)	19	22	23.75	27.50
3.	Medium (6-10)	32	20	40.00	25.00
4.	High (10 and above)	2	8	2.50	10.00

Table 10: Distribution of adopters and non-adopters according to their cropping pattern under CA

S. No.	Categories	frequency		Percentage	
		A	NA	A	NA
1.	Rice- Wheat	38	27	47.50	33.75
2.	Rice- Wheat/ Chick Pea	06	30	7.50	37.50
3.	Rice- Wheat - Moong/Urd	36	23	45.00	28.75
	Total	80	80	100	100

Table 11: Distribution of farmers according to their level of annual income

S. No.	Categories	frequency		Percentage	
		A	NA	A	NA
1.	Very low (35000- 1,00,000)	0	23	00	28.75
2.	Low (100,001-1,65,000)	24	28	30.00	35.00
3.	Medium (1,65,001-2,30,000)	35	19	43.75	23.75
4.	High (above 2,30,000)	21	10	26.25	12.50
	Total	80	80	100	100

Conclusion

The project has made significant impact on adopters of district Jabalpur. The farmers have positive attitude towards technology. It was found that, though CA technology is fastly adopted by large land holders, but it is also feasible for small and medium land holding farmers. The conservation of fuel during land preparation, saving in seeds and its seeding, irrigation water, labour and the overall profitability gains shown positive change in attitude of farmers towards this technology. Hike of 13 and 15 per cent in Rice and Wheat productivity was witnesses. The yield advantage in CA over conventional tillage system has created interest among the farmers to adopt the new tillage technologies. Considering the above advantages, farmers have started adopting this technologies and adoption has been widespread in district Jabalpur and covers an area of 1000ha. As this technology is new, thus, in the present research, it was revealed that, 30 per cent of the adopters practice CA in 2-4 ha area, while 22.50 per cent, have only .405 ha area under CA, which shows the need for dissemination of this new technology. Keeping the importance of speedy technology dissemination the planners, extensionists should consider the farmers' preferences as well as their perception about credibility of different sources of technology dissemination. To achieve this the government agencies need to plan, conduct on farm trails on CA technologies in farmer's field with farmer's participation. They may act in term of a more friendly with the largest group as the input agencies do. This will improve their acceptability, credibility and accessibility as well as the rate of technology adoption among the farmers.

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