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ADOPTION OF INNOVATIONS AND AGRICULTURAL MECHANISATION IN DISTRICT PRATAPGARH, U. P.

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ABSTRACT : India, like many other developing countries also confronts complex problems pertaining to the developmental issue especially upliftment of the rural masses. The agriculture, infact, provides a means of livelihood to the majority of the rural people. The farmers are moving only gradually and even hesitantly towards the adoption of innovations. No doubts, the overall agricultural output has substantially increased during last forty years but economic condition of rural people continues almost unaltered owing to the fact that mostly the farmers have small landholdings with constrained or little access to innovations. Keeping in view the above facts, it has been tried here to discuss the adoption of innovations and level of agricultural mechanisation in district Pratapgarh. The study has been divided into two sections. First part deals with spatial variation in adoption of innovations while second part highlights the level of agricultural mechanisation in eight sample villages selected from different physiographic divisions.

INTRODUCTION

The scientific and technical knowledge has grown considerably in different fields. In the fields of Indian agriculture, the farmers are moving only gradually and even hesitantly towards adoption of innovations. The Green Revolution has turned the country into an exporter of agricultural produces. But in this regard Singh (1989) has rightly remarked that no doubt the overall agricultural output has substantially increased during the last two decades, but the economic condition of the rural society continues almost unaltered owing to the fact that mostly the agriculturists are small farmers with contrained or little access to innovations. The majority of the farmers are deprived of irrigation facilities and they cannot afford the high cost of HYVs, chemical fertilizers and other advanced agricultural technologies. As a result, this section of society is still using traditional technologies in the way of farming which has retarded their progress.

According to Singh (1989) in the process of innovation diffusion, a novelty is adopted by those who had not already adopted it earlier in an area. The Geographers focus their attention to the temporal and spatial system in the process of innovation diffusion. Hagerstand (1967) in his pioneer work, has tried to predict the spatial distribution of an innovation when it is diffused with basic assumption that as the spatial distance between an adopter and non-adopter of an innovation decreases, the probability of adoption in the later increases and vice-versa. Besides spatial range, the process of diffusion of an innovation is also related with socio-economic status (income, occupation, education, Hagerstrand, 1952) of the non adopter and accessibility of the area where he lives. Finally comes the element of

time as the least component in the whole diffusion process but it plays the key role in diffusion research (Katz, E. and others, 1963). The innovation takes place through time over space. Studies have revealed that an innovation is not adopted by different people or communities at one time due to several social, economic and personal reasons. Thus the diffusion of agricultural innovations refers to its inter personal spread among farmers and the time lag between early and late acceptors of that innovation (Shetty, 1966). Keeping in view the above facts, here an attempt has been made to analyse the spatial variation in adoption of agricultural innovations and to determine the level of agricultural mechanisation in district Pratapgarh.

THE STUDY AREA

The district Pratapgarh (3730 km^2) and 22,10,680 persons in 1991) comprises of four tehsils namely Pratapgarh, Patty, Kunda and Lalgang, again sub-divided into 15 blocks (Fig. 1) consisting of altogether 2231 villages and 7 urban centres. The monotonous terrain character is mostly influenced by the rivers Ganga, Gomti, Sai and Bakulahi. Sandy loam soil found in between the Ganga and the Sai is agriculturally important. Climatologically, the study area falls in subtropical monsoon region and more than 89 per cent of total rainfall occurs during the rainy season (July to September). There has been remarkable population growth (76 per cent) during the last forty years (1951-91). The last decade has registered the highest growth rate of 22.74 per cent. This rapid population growth will render the provision of social facilities and improvement in the quality of life quite difficult. Although, about one third of the population is literate yet the female literacy is quite low. There has been marked increase in cultivators and other service groups of work force but the proportion of agricultural labours and industrial workers has declined.

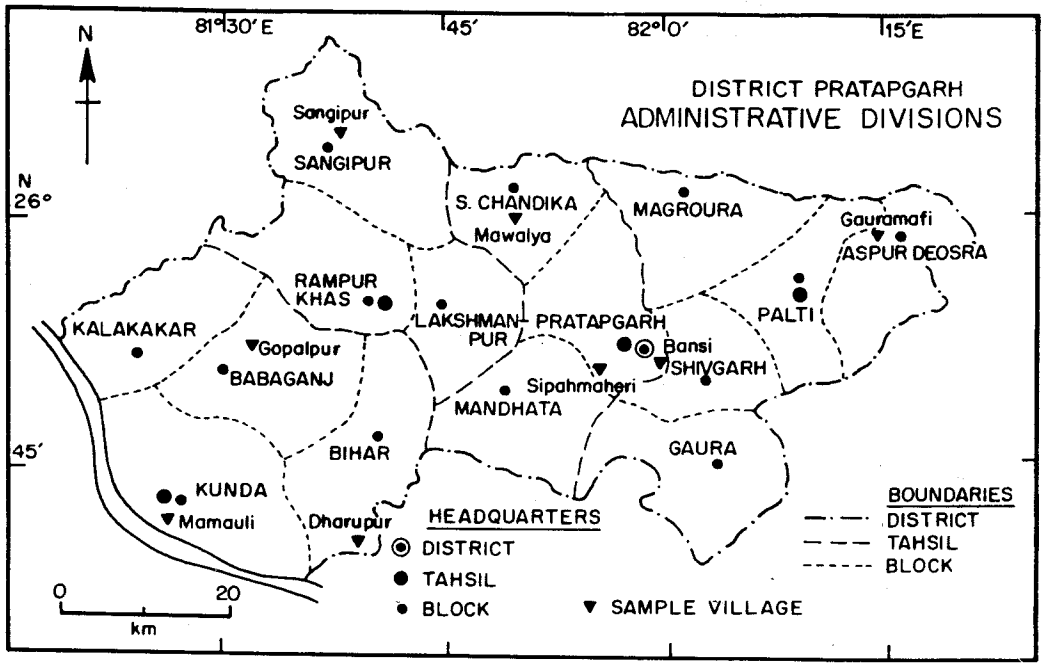

Fig. No. 1

AGRICULTURAL PRACTICES

The agricultural practices include the activities done by farmers starting from the preparation of field units to agricultural produce (Singh, 1988). Generally, in the whole area ploughing is done in traditional manner with the help of wooden plough. The sowing operation is done by either broadcasting the seeds in line pattern or by transplantation method. Irrigation has now been mechanised to a considerable extent. When the crops are matured, they are harvested and carried out to the threshing floor locally called *Khalihan* where they are crushed under the feet of the bullocks known as *Dauri*. The work of separating the grains from straw known as *Oswan* is done by hand labour by the aid of prevailing winds. These are the general agricultural practices performed by the majority of the farmers. But, the study area has experienced great change in the agricultural practices after consolidation. The trend about the adoption of agricultural innovations is gradually increasing day by day especially the use of modern implements like tractor, thresher, sprayer, pumpsets etc.

SPATIAL VARIATION IN USE OF AGRICULTURAL INNOVATIONS

For intensive agriculture, careful attention has to be paid to the preparation, sowing, irrigation manuring etc. The *Desi* (traditional) implements which are widely used in the study area, are simple to manufacture and to maintain by the rural artisan, but they are highly inefficient and would not meet the requirements of scientific agriculture. The improved agricultural implements under use in the study area are tractors, mould-boad ploughs, disc harrows, threshers, winnowing machines, sprayers, pumpsets etc. Though it is still limited to the large and medium farmers or to the few small farmers who are doing intensive and modernised cultivation. However, data is available only for the harrow cultivation, threshers, sprayers and tractors at block level. Therefore, spatial variation in use of these innovations has only been discussed here.

Mechanisation in agriculture is gradually becoming more and more popular, nevertheless, traditional farm methods still dominate in the study area. It is clear from the fact that presently there are 1, 72, 122 wooden plough still in operation. High cost of mechanical devices is the main constraint in adoption of innovations as more than two-thirds of the farmers have very small land holdings. There is significant variation in adoption of innovations at block level. Bihar development block has the largest (512) number of mechanical devices while Babaganj has the lowest (206) in the year 1990. Aspurdeosara is the second largest block with reference to number of agricultural devices (505) followed by Patty (435), Mandhata (383) and S. Chandrika (380). The absolute number of agricultural devices does not present the clear picture of mechanization level. Therefore, it has been tried to compute the intensity of agricultural innovations, i.e. the number of innovations per thousand hectares of agricultural land and the whole development blocks have been divided into three intensity zones. Kalakankar block falls into the highest intensity zones with 16.2 harrow cultivators per thousand hectare of agricultural land while Sangipur and Aspurdeosara into the lowest intensity group with 0.6 and 0.5 number of this innovation respectively. There are three blocks namely, Babaganj, Bijar and Gaura which fall into the madium intensity group (Table 1). The intensity value for thresher machine ranges from 30.9 per 1000 ha in Aspurdeosara block to 3.2 in Babaganj block. Out of total 15 blocks 4 fall in the high and 3 in the low intensity group while remaining 5 blocks are categorised in medium intensity group. The most important agricultural device, i.e. tractor, has an average intensity of 3.87 tractors per 1000 ha. of

Table 1.

Spatial variation in adoption of agricultural innovations (1990)

Block	Absolute no. of innovations					Intensity (no. of innovations 1000 ha Agl. land)				
	Harrow cultivators	Threshers	Sprayers	Tractors	Total	Harrow cultivators	Threshers	Sprayers	Tractors	Total
Sadar	19	135	24	55	237	1.5	10.7	1.9	4.4	18.8
Lakshmanpur	13	179	23	50	265	1.1	14.5	1.8	4.0	21.4
Mandhata	14	279	28	62	383	1.1	21.1	2.1	4.7	28.9
S. Chandrika	16	295	28	41	380	1.1	21.3	2.0	2.9	27.4
Sangipur	10	210	11	64	295	0.6	12.6	0.7	3.8	17.7
Kunda	102	114	25	35	276	6.4	7.6	1.5	2.2	17.2
Kalakankar	200	92	42	37	376	16.2	7.4	3.4	2.9	30.4
Babaganj	48	48	44	46	206	3.2	3.2	2.9	3.0	13.6
Bihar	51	176	199	80	512	3.4	11.8	13.4	5.4	34.5
Rampur Khas	18	263	34	69	393	0.9	13.8	1.8	3.6	20.7
Patty	21	312	17	85	435	1.6	23.5	1.3	6.4	32.8
Gana	33	207	18	60	318	2.2	14.0	1.2	4.1	21.5
Shivgarh	25	149	15	42	231	1.8	11.1	1.1	3.1	17.1
Mangraura	-	281	7	79	367	-	10.7	0.4	4.2	19.7
Aspurdeosara	7	435	18	45	505	0.5	30.9	1.3	3.2	35.9
Total	577	3175	353	850	4979	2.62	14.4	1.6	3.8	22.6

Source : District Statistical Hand Book 1990, Pratapgarh.

agricultural land (Fig. 2). Its value ranges from highest 6.4 in Patty to lowest 2.2 in Kunda block. Excluding four development blocks namely, Patty (the only block in highest intensity group), S. Chandrika, Kunda and Kalakakar (low intensity group) all the remaining 11 blocks fall in the medium intensity group. It is mainly because of the fact that spatial variation in number of tractors per 1000 ha. of agricultural land at block level is less in comparison to other agricultural devices.

Overall (including all the agricultural devices) intensity is highest (35.9) in Aspurdeosara (Fig. 2) block followed by Bihar (34.5), Patty (32.8) and Kalakankar (30.4) blocks while lowest intensity (17.1) is found in Shivgarh block followed by Kunda (17.2) and Sangipur (17.7) blocks. The intensity of medium group ranges from 20 to 30 number of devices per 1000 ha of agricultural land and there are five blocks in this category. It has been found that size of land holdings, availability of irrigation facilities, socio-economic condition of the peasants and to some extent literacy are the major factors which have influenced the adoption of agricultural innovations in the study area.

AGRICULTURAL MECHANISATION

Agricultural mechanisation is concerned with the use of innovations like tractors, pumpsets, sprayers, threshers etc. replacing the traditional way of farming to raise the agricultural production. It is the agricultural mechanisation which has turned the country from an importer to exporter of foodgrains. Therefore, our peasants must be encouraged to adopt an

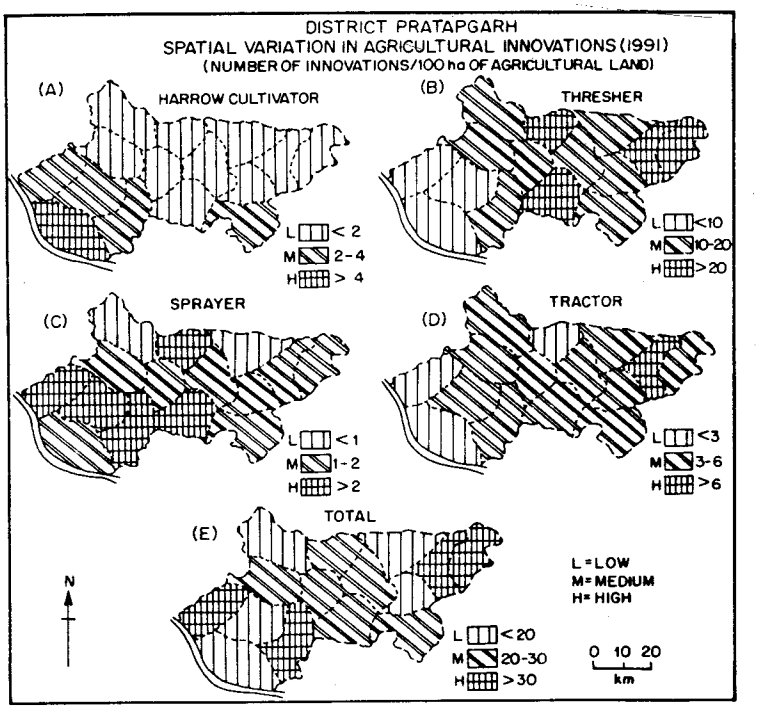

Fig. No. 2

appropriate technology in farming to increase their agricultural yields.

To determine the level of agricultural mechanisation, secondary information regarding adoption of mechanical devices at family level is not available for the study area. Therefore, a detailed household survey for 1215 families of eight sample villages was carried out in 1992. The nature of information collected through questionnaire at family level is related with type of mechanical devices in practice, size of land holdings, year of adoption, educational level and caste of adopters, use of HYVs and chemical fertilizers, etc. The year 1970 has come out as the starting year of mechanisation in the sample villages and the types of mechanised devices under use at present are tractor, tractor-trolley, electrified tubewell and pumpset, diesel oil operated pumpset, power thresher, chaff cutter, pesticide sprayer, sugarcane crusher and paddy husker etc.

METHODOLOGY

In order to identify the level of agricultural mechanisation, the scoring and indexing techniques used by Singh and Maurya (1981) have been applied in the present work. Scores have been alloted to a particular mechanical device for a family on the basis of number of years the device was first introduced in that family. For example, if a particular family has been using a particular device for two years two points are given for that particular device and if the another family has been using the same device for five years, five point will be alloted. The same technique has been followed for each device in practice and the highest scores obtained by them is given in table 2.

Table 2.
Mechanised Devices in Use and their Scores in Sample Villages Pratapgarh District.

Mechanised device in use	Total number	Score
Tractor	13	22
T ractor-trolley	5	6
Tubewell	2	22
Diesel Pumpset	115	12
Thresher	181	22
Powerchaff cutter	191	12
Pesticide sprayer	34	10
Biogas plant	16	22
Sugarcane crusher	56	22
Paddy husker	1	4

The types of mechanical devices in use and scores obtained by them shown in table 2 reveals that tractor, tubewell, thresher, biogas plant and sugarcane crusher are the oldest devices of the sample villages. This also reflects that their adoption year is the same. Paddy husker and tractor trolley are recently introduced mechanical devices in the same villages.

The sum of scores of the particular devices in use in a particular family represents the agricultural mechanisation level of that family and it has been called by Singh and Maurya (1981) as Family Mechanisation Index (FMI). Thus sum of all the FMIs for a particular village will be the indicator of concentration of mechanization in the concerned village. As observed by Singh and Maurya, the absolute summation of the FMIs for individual villege fails to denote the mechanization intensity in comparative terms as simply summing up of FMIs for a village does not take into account the households deprived of mechanization in the village as also it fails to incorporate the relative position of the village in terms of the average Mechanization level of the study area (Singh and others, 1981). To eliminate above irregularities they have suggested to compute the VMI (Village Mechanization Index) as follows :

$$\text{Village Mechanization Index (VMI)} = (\text{E FMI}) \times \text{P/MP}$$

Where FMI is the family mechanization index, P is the percentage of mechanization adopting households to the total number of households in the village, MP the mean percentage of the mechanization adopter households to the total number of households in the sample village.

The same method has been followed here to obtain the agricultural mechanization level for eight sample villages of the study region. Their village mechanization indices thus computed are given in table 3.

Table 3.
Level of agricultural mechanization in sample villages (1992)

Village	Total number of household	No. of household having any kinds of adoption	FMI	VMI
Dharupur	174	75	632	379.2
Gopalpur	91	63	864	838.1
Mamauli	111	42	302	160.1
Gaura	116	96	998	1147.1
Mawaiya	122	87	878	869.2
Sangipur	203	141	1152	1117.4
Sipah Maheri	261	236	1709	1776.3
Bansi	137	127	1377	2153.3

Mean of all the VMIs (1055) has been considered as standard value to divide the sample villages into high and low level of agricultural mechanization. The villages namely, Gaura (1147), Sangipur (1117), Bansi (1776) and Sipah Maheri (2153) have been classified in the high level of agricultural mechanization while remaining villages with less than 1055 their VMIs fall into low level of agricultural mechanization. The spatial distribution of these villages depicts very interesting picture. Generally the villages located

in eastern part of the district are characterised by high level of agricultural mechanisation while low mechanised villages are found in western region except Mawaiya located in northern part. The economic prosperity, educational level and physical availability of the devices are major factors responsible for adoption of innovations.

Table 4.
Educational level of mechanisation adopters in sample villages (1992)

Educational level of adopters	Number of adopters	Percent of total adopters
Illiterate	22	2.53
Primary school	80	9.20
Junior High School	207	23.97
High School	398	45.90
Intermediate	88	10.1
Graduate	44	4.61
Postgraduate	32	3.69
Total	867	100.00

Table 4 shows that out of the total 867 adopter families, maximum 398 respondents (45.9%) have received their education upto high school. There are only 160 respondents (18.0%) who have their educational background up to intermediate or above. Thus, low educational level adopters consitute more than 81 per cent of the total adopters. Therefore, the hypothesis that the educational level plays an important role in innovation adoption is partially tenable with reference to study area.

GROWTH OF INNOVATIONS

Tubewell and Pumpset

The Indian agriculture mostly depends on monsoon. Sometimes uncertainity in monsoon badly affects the Indian farming. Invention of modernised means of irrigation has brought major changes in cropping pattern and crop yield both. Modernised means of irrigation includes lift canal network, tubewell and pumpsets. Among all the mechanical devices, tubewell and pumpset constitute third largest number (117) in the sample villages. The pumpset was first introduced in the sample villages in 1980 but upto May 1992 their number increased to 115 (Table 5). Pumpsets are generally operated by electric power or

Table 5.
Growth of innovations in sample villages

Year	Tractor	Tractor trolley	Pump set	Tube well	Thresher	Chaff cutter	Pesticide sprayers	Paddy husk
1970	1	-	-	1	4	-	-	2
1980	1	-	2	-	6	20	-	18
1981	-	-	6	-	7	11	-	3
1982	1	-	7	-	4	7	1	2
1983	1	-	10	-	47	40	3	5
1984	1	-	8	1	23	19	6	7
1985	-	-	12	-	11	15	7	3
1986	-	1	9	-	19	16	4	2
1987	2	-	11	-	18	21	7	4
1988	-	-	18	-	10	8	1	1
1989	3	3	22	-	22	24	8	5
1990	3	-	9	-	8	6	1	3
1991	-	1	1	-	2	4	1	1
Total	13	5	115	2	181	191	34	56

Table 6.
Number of tractor owners according to size of land holdings.

Size of land holdings in ha	Number of owners	Percent to total number of owners
Above 20	3	23.07
15-20	5	38.48
10-15	4	30.76
Below 10	1	7.69

diesel oil in the study area. The main problem associated with these devices is irregular supply of electricity and non-availability of diesel.

Tractor

Tractor is found to be the key for mechanizing agriculture but its density is still very low in the survey villages because of high costs and small land holdings. Increase in labour wage and legislation related to abolition of *Zamindari* system and tenancy rights have forced the big farmers to adopt tactors. The tractor has played an important role in Indian agriculture. It is not only beneficial for agriculture but it is also used for commercial purposes.

Due to high cost of tractor and small land holdings of majority of the farmers, it is restricted to the large farmers only. There are 13 tractors in eight sample villages. The tractor was introduced in the sample villages first in 1970 and then after a long gap of 10 years in 1980 another tractor was introduced. After 1980, gradual increase in number of tractors was observed in the villages and increased to 13 in 1992 (Fig. 3). Being costly and heavy tilling machine, it is generally used by the large land holders. From table 6 it is clear that out of the 13 total tractor adopters, 5 respondents (38.40%) have 15-20 ha size of land holdings

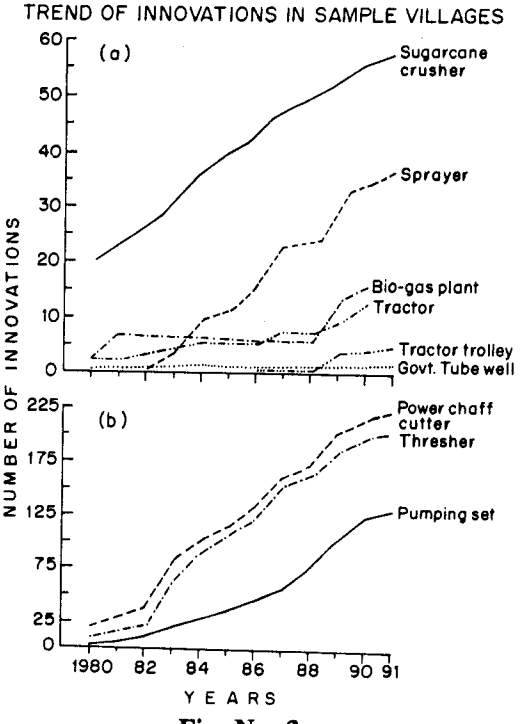

Fig. No. 3

while the holdings of 10-15 ha accounted for 30.76 per cent.

There is only 1 family having size of land holdings below 10 ha which had a tractor. Thus, size of the land holdings is the main determinant in adoption of tractor in the study area.

Castewise analysis reveals that the Rajput and brahmins are the dominant castes in the sample villages having 7 and 2 tractors respectively (Table 7). Yadav, Pasi, Muslim and Bania are the other castes who have adopted tractors in agricultural farming along with commercial use.

Table 7.
Distribution of tractors by caste in sample villages

Caste	No. of tractor	Percent of total adopter
Rajput	7	53.86
Brahmin	2	15.38
Yadav	1	7.69
Muslim	1	7.69
Bania	1	7.69
Pasi	1	7.69
Total	13	100%

Tractor Trolley, Paddy Husker and Chaffcutter

The tractor trolley was first introduced in 1986 after 16 years of introduction of tractor and increased to 5 in 1992. Power dependent innovations like thresher, paddy husker, chaffcutter and sugarcane crusher are generally run by electric and diesel pumpset or tractor in the study area. Thresher and paddy husker both were introduced in 1970 while chaff cutter was brought in use after 10 years in 1980 in sample villages. Table 5 depicts that numerical growth of all these innovations follows the growth in number of pumpsets during the year 1980 to 1991. More than 80 per cent of threshers, paddy huskers and chaffcutters were introduced during the aforesaid period. The same table also shows that the largest increase in threshers, chaff-cutters and crushers occurred during the year 1983-85. These devices are time and labour saving. Therefore, all the innovations gained popularity after consolidation operation, expansion of irrigation facilities and introduction of HYVs in the villages.

Pesticides Sprayers

After induction of this innovation in the year 1982, it increased to 34 in the sample villages upto 1991. Maximum number of pesticide sprayers were brought during the years 1987 and 1989 (Table 5). Thus, pesticide sprayer is the latest innovation of the region brought in use after introduction of various kinds of new seeds in the area.

Conclusion

From the above discussion, it may be concluded here that the adoption process of innovations is very slow in the study area. Small size of land holdings, lack of proper and adequate means of irrigation facilities, poor economic condition, high cost of mechanical devices and their high maintenance cost etc. are the important factors responsible for slow adoption. Thus, study area needs an appropriate rural technology suitable for small size of land holders.

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