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ADOPTION OF HIGH YIELDING VARIETIES
IN THREE INDIAN VILLAGES

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in Rural Societies

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PREFACE

This is a special report on high yielding varieties of the Diffusion of Innovations project which was undertaken in collaboration with Michigan State University. Other special reports focus on adoption of health practices, adoption of family planning, and on an analysis of opinion leadership in relation to the adoption of new practices. There will also be an anthropological report of adoption in a West Bengal village.

Major reports of the project have been Agricultural Innovations in Indian Villages (NICD, March, 1968), an analysis of 108 villages; Agricultural Innovation Among Indian Farmers (NICD, In press), an analysis of 680 Indian farmers; and Communication in India: Experiments in Introducing Change (NICD, In press), a study of communication treatments in six villages. Data for this report on high yielding varieties in three Indian villages were obtained from part of the sample used in the second major report, of 680 farmers in eight Indian villages.

Directors of the Diffusion of Innovations project were F.C. Wiegand, Prodyoto Roy, J.E. Kivlin, L.K. Sen and J.P. Bebermeyer. The field teams were supervised by A.K. Danda, B.K. Reddy and S.S. Thorat. Members of the teams, who also did the bulk of the coding and tabulation, were D.K. Bhowmik, P.K. Chatterjee, B.R. Patil, K.S.S. Raju, J.M. Rao, S. Rudra, J. Sahabhomik, S.K. Shelar, P.M. Shingi, G. Subharatnam and V.K. Surkar. The manuscript was typed by

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Hyderabad,

Dated 20th May, 1968.

INTRODUCTION

Recent developments in agricultural technology have brought out certain new varieties of food grains which are being currently propagated by the change agencies charged with the diffusion of modern technology among Indian farmers. It has been demonstrated that these new high yielding varieties (HYV) may give two to three times more yield than traditional local varieties of food grains. It is assumed that widespread adoption of HYV will generate a break through Indian agriculture leading to self sufficiency in food requirements. This approach of emphasis on HYV is termed "the strategy" for increased production on farms.¹ The new strategy includes the use of heavy doses of inputs in the form of a package of practices. In addition to the new seed varieties, fertilizers and insecticides, and certain new approaches to mass communication, mainly through radio and printed material, are also part of the new strategy. Provision of timely and cheap credit is another important element of this strategy.

The principal objective of this study was to find out the various factors influencing the adoption of high yielding varieties of food grains. Through this research, it was proposed to identify those groups or categories of farmers who are likely to accept and adopt HYV and to identify those factors which influence the adoption of HYV. Factors which have been studied are those related to use and availability of fertilisers and credit, communication channel use

and media credibility, economic factors, demographic factors, communication factors, extension contact and knowledge, and social psychological variables. A knowledge of such factors is essential for both planners and Extension personnel who are concerned with the promotion of HYV.

In this report we will also compare the association of various independent variables and the adoption of HYV with the association of these same independent variables and a broader agricultural adoption index, representing the adoption of ten agricultural practices studied in the second phase of our larger study. This comparison was undertaken to determine whether general adoption research findings can be assumed to hold for the crucial specific innovation of HYV.

Background of the study:

Data for this study were gathered during the second phase of a larger study, which consisted of three main phases.² In the first phase we took the village as the unit of analysis and studied factors that facilitate or inhibit the success of agricultural programmes in villages. One hundred and eight villages were studied in the three states of Andhra Pradesh, Maharashtra and West Bengal. In the second phase, we studied the individual farmer in his family and village setting. Social setting, personal characteristics, socio-psychological variables and economic factors were the main focusses of this second phase. We interviewed 680 farmers in eight of the same villages which we had studied

in Phase 1. In the third phase of our study, using a different sample, we conducted communication experiments, designed to induce greater acceptance of modern technology, in a limited number of villages.

Sample and procedure:

This study of high yielding varieties was carried out in three villages of the Intensive Agricultural District Programme³ area in Andhra Pradesh.⁴ The sample, as part of Phase 2 of our larger study, was restricted to farmers who actually made the day-to-day decisions on the farm. We interviewed only those who were not more than fifty years of age and who were farming at least 2.5 acres of land (1 hectare) at the time of data gathering. Both owner farmers and tenant farmers were interviewed. Farmers who cultivated less than 2.5 acres were excluded because it was felt that many modern practices, particularly the high investment package of practices necessary for HYV, could not be adopted very practically by farmers on small holdings. The reason for restricting age of respondents was to avoid ambiguous decision-making resulting from situations in which the older generation is handing over responsibility to the younger. A total of 209 farmers were interviewed in Andhra Pradesh who satisfied the sampling criteria. After completing the interviewing, the data were coded, tabulated, and wherever possible indexes were constructed. The general procedure followed in coding, tabulating and constructing of indexes was the same as that followed in the main study. The coded data on HYV were verified and then punched onto McBee sort cards for hand tabulation. The

data were dichotomised and cast into chi square tables. The main study Phase 2 comparison data were analysed by both chi square and correlational analysis. Statements of relationship between dependent and independent variables, rather than frequencies or percentages, are made for parsimony in presentation and to facilitate comparison between chi square and correlational analysis.

The dependent variable used in the present report is "ever used a high yielding variety". The three questions asked to elicit information about HYV were "Do you know anything about high yielding varieties", "Have you ever used any high yielding variety" and "Are you still using any high yielding variety". "Ever used" was taken as our dependent variable, adoption of HYV, to facilitate comparison with Phase 2 data of the larger study (in which "ever used" was also the measure of adoption) and because sometimes seeds were not available and hence the farmer did not have a fair chance to continue use.⁵ Since these varieties were of recent introduction they were often in short supply. There were 55 cultivators in our sample of 209 who had ever used HYV. In every case, the seed was an improved, high yielding variety of rice. Measurement of each independent variable is discussed in the text together with its relationship with adoption behaviour. The analysis of data is presented in the following sections.

ANALYSIS

Fertilizer and adoption of HYV:

Fertilizer is an important input factor in the adoption of high yielding varieties. One of the outstanding features of HYV is their ability to respond to heavy applications of fertilizer without undesirable side effects such as lodging or blowing down of the grain. Hence we considered fertilizer use, fertilizer availability and fertilizer use orientation in relation to adoption of HYV, Table 1. As we expected, there was a strong positive association between fertilizer use and adoption of HYV. The 55 cultivators who had adopted HYV were significantly more apt to have purchased higher amounts of fertilizer.

Table 1 shows that most of the 209 cultivators in our study sample reported that it had been difficult to get fertilizer in 1966. Those who had adopted HYV were somewhat less apt to report difficulty than those who had not adopted HYV, but the relationship was not significant. A little less than half of the 209 cultivators said they would have bought some more fertilizer had it been available. Those who had adopted HYV were somewhat more likely to have reported interest in further purchases but the relationship was not significant. We conclude that fertilizer use was a largely accepted practice in our study sample. Only 15 per cent of our 209 cultivators had used no fertilizer in

district, reported difficulty in obtaining fertilizer. It is likely that the bulk of India's cultivators, who do not farm in a package district where attempts are made to make inputs readily available, experience substantially more difficulty. Despite the difficulty reported in obtaining fertilizer, however, there were signs that some cultivators had all the fertilizer they needed or at least all that they could afford or wanted. Less than half of our study sample said that they would have bought more if it had been available. It is likely that some of the availability problems are attributable to lack of credit or to faulty storage and distribution facilities, rather than to an actual shortage of fertilizer.

Credit and adoption of HYV:

Credit is another very important resource in the adoption of HYV. The relationships between adoption of HYV and credit use, credit availability and credit use orientation are presented in Table 2. None of these three credit factors is significantly related with adoption of HYV.

Credit use was measured with the question "Did you use any credit for farming purposes during the past year". The responses were of a dichotomous nature only, indicating yes or no. We did not get information from the respondents about the actual quantity of credit they had used. About two-thirds of the cultivators reported that they had used

Table 2. Relationships Between Adoption of HYV and Credit Use, Credit Availability and Credit Use Orientation.

	Adoption of HYV		
	No	Yes	Total
----- frequencies -----			
Credit use (Did you use any credit for farming purposes in 1966)			
No	53	19	72
Yes	101	35	136
Total	154	54	208
Credit availability (Has it been difficult to get credit)			
No	16	10	26
Yes	119	44	163
Total	135	54	189
Credit use orientation (Would you have used some/some more credit had it been available)			
No	37	21	58
Yes	117	33	150
Total	154	54	208

credit, the rest having used no credit at all. This was true for both adopters and non-adopters of HYV.

Credit availability was measured with the question "Has it been difficult to get credit". Adopters of HYV were

somewhat less apt to report difficulty in obtaining credit than were non-adopters. The striking finding is that, for all 189 cultivators for which we had information, over 80 per cent reported difficulty in obtaining credit.

Credit use orientation was measured by the question "Would you have used some/some more credit had it been available".⁶ About three-fourths of the sample said that they would have used more credit. Adopters of HYV were somewhat less apt to report that they would have used more. This is consistent with the finding that users of HYV reported less difficulty in getting credit.

Our conclusions about these credit factors are quite similar to those which we drew about the findings on fertilizer as a factor in the adoption of HYV. Most cultivators in our study sample had used credit in 1966 but most cultivators also said that they had difficulty in obtaining credit and would have used more had it been available. Credit, like fertilizer, can be in short supply. However, unlike fertilizer, credit can be created by judicious manipulation of monetary policy and by imaginative, creative extension of banking procedures already known. Some cultivators are undoubtedly poor risks, and some will divert agricultural loans for marriage feasts or other consumption expenditures. Nevertheless, we believe that credit facilities can and should be increased in a selective, rational manner. Such an increase is likely to bring with it more of

the agricultural production for which high yielding varieties hold out promise.

Communication channel use and HYV:

Adoption of an improved practice by an individual usually occurs through several stages. Various studies have researched the stages in the process of adoption of a practice.⁷ The five stages which have been most widely accepted are awareness, interest, evaluation, trial and adoption. We analyzed two stages in adoption of high yielding varieties, awareness and trial. The questions asked to elicit information were: "How did you first come to know about high yielding varieties"? and "From whom or what sources did you get information which convinced you to try them"? Communication channels were classified as informal personal sources (relatives, friends and neighbours), formal personal sources (change agents such as BDO or VLW), mass media (radio, newspapers), and place (such as market or city). We present data for the awareness stage for both adopters and non-adopters and, of course, for the trial stage we present data only for adopters, Table 3. The most striking finding shown in Table 3 is the great importance of change agents. They were mentioned by 70.7 per cent of the adopters as a source for first information about HYV (awareness stage), and by 85.5 per cent of the adopters as a source of information which convinced them to try HYV (trial stage). Friends and relatives and other informal personal sources of information were not very important for

adopters but were the most important source of information for the non-adopters. Change agents were mentioned by 36.1 per cent of the non-adopters.

Table 3. Communication Channel Use in Relation to the Awareness and Trial Stage of Adoption of HYV.

Sources of information	Awareness stage				Trial stage	
	Adopters		Non-adopters		Adopters	
	No.	Per cent	No.	Per cent	No.	Per cent
Informal personal sources (Friends, relatives)	6	10.9	71	46.2	2	3.6
Change agents	39	70.9	56	36.4	47	85.5
Mass media	10	19.2	11	7.1	2	3.6
Place	--	--	9	5.8	1	1.8
No information	---	--	7	4.5	3	5.6
Total	55	100.0	154	100.0	55	100.00

The mass media were more important at the awareness stage than at the trial stage of adoption, as might be expected. The mass media are not so much convincing as informative. However, the mass media were overshadowed by change agents and personal sources. They were more important for adopters than for non-adopters at the awareness stage. This is consistent with the higher educational level and greater use of the mass media by adopters of HYV, which we will show in a later section of our report.

Media credibility and HYV:

In recent years much emphasis has come to be placed on mass media as a means for disseminating farm information, and plans are afoot to build up mass media programmes to cater to rural audiences. While demonstrations and personal contacts through village level workers are considered more influential and effective, in terms of cost of coverage they pose severe limitations. Hence, we investigated the credibility of these sources to the farmer. Media credibility is concerned with the belief that cultivators, in general, placed in one source of information as compared to others. In other words what is the information source about HYV in which cultivators are likely to believe and which will convince them to try HYV?

Four much used sources of information, namely radio, neighbours, demonstrations, and the VLW were considered. Respondents were asked six forced - choice questions in which each of the four sources was compared with every other source. Thus each source could be chosen from 0-3 times by each respondent. The question asked was "If you heard about a new variety of crop that was said to improve your income, would you be more likely to try it if you heard about it from the radio or from the VLW ... from a VLW or from a neighbour ... from a neighbour or by a demonstration ... and so forth until all possible comparisons had been made. The number of times each source was chosen is shown in Table 4.

Table 4. Number of Times More Credible Information Source was Chosen by Respondents.

Source of Information	Adopters of HYV					Non-adopters of HYV				
	0	1	2	3	NA	0	1	2	3	NA
Radio	42	8	4	0	1	109	27	13	1	4
VLW	8	27	16	3	1	29	69	46	6	4
Neighbours	7	16	28	3	1	23	47	68	12	4
Demonstrations	0	1	6	47	1	3	5	19	123	4

The data clearly indicate that cultivators placed most reliance upon agricultural demonstrations followed by neighbours, VLWs and radio, in that order. In spite of the criticism which some cultivators in our sample directed against demonstrations conducted in their block, as being of poor quality, we conclude that demonstrations are a very potent tool in the hands of change agents in India. Neighbours and VLWs occupy intermediate positions in credibility, after demonstrations, but it should be remembered that it is the VLW who conducts most of the demonstrations in cooperation with a farmer in the village. The degree of credibility accorded to neighbours as an information source speaks of the need for greater utilisation of local channels of communication in disseminating technology, and of the need for working through local leaders in getting acceptance of modern agricultural practices. Similarly, the intermediate degree of

credibility placed in the VLW per se is perhaps due to the fact that VLWs are not always sound in their knowledge about the latest technological developments. It is to be remembered here that high yielding varieties and other complex innovations are of recent introduction in Indian farming. Efforts must be made to improve the technical competency of the VLW through orientation courses and other training which will bring his knowledge up to date.

Least credibility was assigned to radio as a source of information which would persuade a cultivator to try a new practice. As we indicated in the previous section, radio and other mass media are not so much convincing as informative. However, it is likely that greater attention should be paid to farm radio programmes, so as to design them specifically for their target audience. During the field interviews the remark was often heard that radio programmes relating to farming matters go over the heads of cultivators and what is told on the radio does not fit local field and seasonal conditions. It may be that generalised broadcasts aimed at broad regional requirements do not serve their purpose. It is likely that broadcasts on specific topics, aimed at a specific audience, would be more useful. Radio farm forums would be one way to make radio programmes more relevant and useful.

Adoption of ten agricultural practices and adoption of HYV:

In the larger study of 680 cultivators, of which the

present study on HYV is part, we constructed an adoption index of "ever used" ten agricultural practices.⁸ HYV was one of these ten items.⁹ The relationship between adoption of these ten practices and adoption of HYV was positive and very strong, Table 5. Ninetyfive per cent of those adopting HYV had adopted seven or more of the ten practices (which included HYV). This is important because diffusion research has generally shown that the adoption of one innovation has not been an especially good predictor of the adoption of other innovations. In this instance, however, the two measures of adoption are closely related and suggest that the general body of adoption research can be drawn upon for guides to the promotion of high yielding varieties of seeds. In the sections which follow we will show the relationship between our independent or explanatory variables and adoption of the ten agricultural practices, as well as the relationship of the independent variables with adoption of HYV. These relationships are given in descriptive statements for case of comparison and demonstrate great similarity. This similarity of findings gives increased support for the relevance of general diffusion research for the currently critical interest in HYV.

Economic variables and adoption of HYV:

We tested the relationship of six economic variables with adoption of HYV, Table 6. Except for tenure status (percentage of land cultivated which was owned), relationships

Table 5. Relationship Between Adoption of HYV and Adoption of Ten Agricultural Practices

Adoption of ten practices	Adoption of HYV	
	No	Yes
	- - - - - per cent - - - - -	
	(N = 154)	(N = 55)
0 to 6	59	5
7 to 10	41	95

$X^2 = 47.11$, p less than .001, df = 1.

of these economic variables with HYV was the same as for ten agricultural practices in the larger study. Two measures of farm size are presented, number of acres cultivated and value of agricultural products raised. Both measures were positively and significantly related to adoption of HYV. Cultivators with a larger farm or with a higher value of agricultural products raised were more apt to adopt HYV.

Commercialization was measured as the percentage of crops raised which was sold. It was expected that the more commercialized cultivators would be more apt to adopt HYV and this is what we found. The relationship is statistically significant.

Farm specialization was measured as the number of different crops raised. Cultivators who grew a larger number of crops were significantly more apt to adopt HYV. We had

Table 6. Some Economic Variables Related to Adoption of HYV and Ten Agricultural Practices.

Variables	Adoption of HYV	Adoption of ten agricultural practices
Farm size (Number of acres cultivated)	More acres cultivated more likely to have adopted*	More acres cultivated more likely to have adopted*
Value of agricultural products raised	Higher value more adoption*	Higher value more adoption*
Commercialization index (Per cent of crops raised which were sold)	More crops sold more adoption*	More crops sold more adoption
Farm specialization (Number of different crops raised)	More kinds of crops raised more adoption*	More kinds of crops raised more adoption
Labour efficiency index (Rupees return per day of labour input)	More efficient more adoption	More efficient more adoption
Tenure status (Percentage of land which was owned)	More land owned more adoption	Less land owned more adoption

* Significant at .01 level of probability, two-tailed test for chi-square or for t .

expected the opposite finding on the grounds that it would be more consistent with rational and commercial orientations toward farming to specialize. An alternative explanation is that diversification might allow the cultivator to exploit more fully the unique features of his farm.

Labour efficiency was measured as the rupee return per day of labour input. By this measure, the more efficient cultivators were more apt to adopt HYV, but the relationship was not significant. We had expected a strong, positive relationship between efficiency and adoption of HYV on the logical grounds that high yielding varieties are basically more efficient in production, as their name implies. We conclude, as we did in the larger study, that the low positive association between efficiency and adoption reflects the high labour inputs required by HYV and the present transitional state of Indian agriculture. It is one of rapid change and of low but rising levels of adoption of innovations. Because of the complexity and interrelatedness of many new practices, it may often be difficult for the cultivator to integrate them efficiently into his farm enterprise.

Tenure status was measured as the percentage of land owned of the total area which was cultivated. Only 15 per cent of the 209 cultivators in our study sample owned none of the land they cultivated. Over half of the cultivators owned at least two-thirds of the land they cultivated. Landowners were somewhat more apt to adopt HYV but the relationship was not significant. An opposite, non-significant finding was noted for adoption of ten agricultural practices and we conclude that tenure status does not seem to be an important variable influencing adoption of HYV at this time.

Of the six economic variables we investigated, four,

including two measures of farm size, were significantly related with adoption of HYV. The most important variable influencing adoption of HYV was farm size. Cultivators with larger farms were much more likely to have adopted HYV. It is apparent that promotional efforts to maximize agricultural production via HYV should concentrate first on cultivators who have the larger units.

Demographic variables and adoption of HYV:

In this section we will outline briefly the association between six demographic variables and adoption of HYV. These variables help to identify characteristics of adopters of HYV. Except for age, these variables are related to adoption of HYV in the same way as with adoption of ten agricultural practices, Table 7. Relationships with age were not significant in either case, and age can be regarded as a factor which was not a good predictor of agricultural innovation in our study.

Adopters of both HYV and ten agricultural practices tended to be those with a higher ritual caste rank,¹⁰ those who were literate and who had more years of schooling, those who had a higher level of living¹¹, and those who participated more in formal organizations. Relationships were statistically significant except for that between education and adoption of ten agricultural practices.

Table 7. Some Demographic Variables Related to Adoption of HYV and Ten Agricultural Practices.

Variables	Adoption of HYV	Adoption of ten agricultural practices
Age of respondent	Young more likely to have adopted	Older more likely to have adopted
Ritual caste rank	High caste more adoption*	High caste more adoption*
Education of respondent	More education more adoption	More education more adoption*
Functional literacy (Can read a newspaper)	Literates more illiterates less adoption*	Literates more illiterates less adoption*
Level of living	Higher level more adoption*	Higher level more adoption*
Participation in formal organizations (Membership and offices held)	More participation more adoption*	More participation more adoption

* Significant at the .01 level of probability, two-tailed test for chi-square or for χ^2 .

It is apparent that adopters of HYV are relatively well-off and well-educated, and that they tend to be active in organizational affairs. These characteristics are consistent with the economic picture of cultivators who have larger farm enterprises and who are more commercialized. Such cultivators constitute a target audience that is apt to be amenable to well-planned programmes of change, which introduce tested, relevant agricultural practices.

Communication variables and adoption of HYV:

Communication is an important factor in the adoption of modern technology. We investigated six communication variables to determine their relationship with adoption of HYV. With all six variables the relationships with adoption of HYV were the same as relationships with adoption of ten agricultural practices, Table 8.

Table 8. Some Communication Variables Related to Adoption of HYV and Ten Agricultural Practices.

Variables	Adoption of HYV	Adoption of ten agricultural practices
Number of newspapers read during past week	More newspapers read more adoption*	More newspapers read more adoption*
Number of commercial films seen	More films seen more adoption	More films seen more adoption*
Listening to radio farm forum	More likely to adopt if listens to RFF	More likely to adopt if listens to RFF*
Listening to news on radio	More likely to adopt if listens to news	More likely to adopt if listens to news
Listening to songs or other entertainment on radio	Less likely to adopt if listens to songs	Less likely to adopt if listens to songs
Urban contact (Visits to town or city)	More urban contact more adoption	More urban contact more adoption*

*Significant at the .01 level of probability, two-tailed test for chi-square or for χ^2 .

Respondents who read more newspapers were significantly more apt to have adopted HYV. These findings reflect our earlier findings of higher educational levels for adopters

and indicate that newspapers can serve as useful communication media in the diffusion of HYV as well as other agricultural innovations. However this usefulness is limited by illiteracy and failure to read even though literate. There were 59 respondents of our total study sample of 209 who could not read and 118 (including illiterates) who had not read any newspapers in the week preceding the interview.

Attendance at commercial films was quite high in our sample. Only ten per cent had seen no films the previous year. This variable probably only describes the adopter of HYV as likely to be a film-goer, however. Commercial cinemas are not a likely channel of communication for promotion of HYV or other agricultural innovations because film audiences are predominantly urban. The number of films seen was positively but not significantly related to adoption of HYV.

We tried to distinguish among different types of radio listening, Table 8, and found that associations with HYV were in the expected direction but were not very strong. Adopters of HYV were more likely to listen to radio farm forums and to news broadcasts and were less likely to listen to songs or other entertainment-type programmes. All but 16 of the whole sample of 209 respondents reported that they did some radio listening. Thus, there appears to be a very substantial target audience for promotion of HYV via radio.

Urban contact was measured by simply counting the

number of visits to a town or city which the respondent reported. Urban contact is an indirect means of communication, one which exposes the farmer to change and may help to develop attitudes favorable to acceptance of change. Cultivators with more urban contact were more likely to have adopted HYV but the relationship was not significant.

Analysis of communication variables further supports the relevance of the general area of adoption research for the specific innovation of HYV. Relationships with adoption of HYV were in the same direction as those for adoption of ten agricultural practices. Although only the relationship of adoption of HYV with number of newspapers read was statistically significant, the direction of relationships of communication variables was consistent with findings reported earlier. Adopters of HYV were not only more educated and had larger farms, but they were more receptive to the mass media and more likely to have contact with the world beyond the village.

Extension knowledge and contact and adoption of HYV:

It was assumed that farmers' knowledge about extension personnel, and contact with them, are important factors in the transmission of information about HYV. The greater the degree of contact which farmers have with extension workers, the greater are the possibilities of being influenced to accept modern practices. Farmers' knowledge about extension

workers was measured by asking the respondents if they knew the names and positions of agricultural health and family planning workers who were assigned to their village. Based on these responses, a simple index of knowledge of extension agents was constructed.¹² Cultivators who had more knowledge of extension agents, as measured by this index, were significantly more apt to have adopted HIV, Table 9.

Table 9. Extension Knowledge and Contact as Related to Adoption of HIV and Ten Agricultural Practices.

Variables	Adoption of HIV	Adoption of ten agricultural practices
Index of knowledge of change agents (Agr. Health, family planning)	More knowledge more adoption*	More knowledge more adoption*
Index of contact with agr. change agents	More contact more adoption*	More contact more adoption*
Number of times talked with VLW	More times talked more adoption*	More times talked more adoption*
Number of times talked with BDO	More times talked more adoption*	More times talked more adoption*
Number of agr. demonstrations seen	More agr. demonstrations seen more adoption	More agr. demonstrations seen more adoption*

* Significant at the .01 level of probability, two-tailed test for chi-square or for r .

We also constructed an index of contact with agricultural extension agents.¹³ This index was also related

positively and significantly with adoption of HYV. Adopters had substantially more contact with extension personnel than did non-adopters.

Because of the importance of the Block Development Officer (BDO), the Village Level Worker (VLW) and the agricultural demonstration, we have shown separately in Table 9 the relationships between adoption of HYV and contact with these officials and this activity. All three contact variables are positively related, and contact with BDO and contact with VLW are significantly related, to adoption of HYV. As might be expected, cultivators had much more contact with the VLW than with the BDO. Only one of the 55 adopters of HYV reported no contact with the VLW during the year prior to the interview. Only 28 of the 154 non-adopters of HYV reported that they had not talked with the VLW in the past year. These findings indicate that the increase in number of VLWs which has been made under the HYV and package programmes is justified and is paying dividends. These findings are a pointer that farmers can be persuaded to make changes through intensive use of personal contacts by change agents. As resources permit, the number of VLWs should be increased and their training and competence improved, to match the increasing complexity of farm problems.

Agricultural demonstrations are widely used to promote new farm practices. In the larger study we found that an

average of over seven demonstrations per village were given during a two year period. The number of demonstrations seen was positively but not significantly related to adoption of HYV, Table 9. However, the number of demonstrations seen was positively and significantly related with adoption of ten agricultural practices.

Without doubt, extension knowledge and contact are important factors in the adoption of HYV. Furthermore, relationships of extension knowledge and contact with adoption of HYV are very similar to those with adoption of ten agricultural practices. While extension methods must constantly be reappraised and kept up to date, there is little question but that current methods are producing results and that extension efforts to encourage use of HYV should be intensified. There is much scope for increased adoption.

Some social-psychological variables and adoption of HYV:

We considered five variables which we call "social-psychological" because they concern the linkage of an individual with the society in which he lives. Although the relationships of only two of these variables with adoption of HYV were statistically significant, all were positive and all were in the same direction as relationships of these same variables with adoption of ten agricultural practices, Table 10.

Table 10. Some Social-Psychological Variables Related to Adoption of HYV and Ten Agricultural Practices.

Variables	Adoption of HYV	Adoption of ten agricultural practices
Knowledge of political leaders	More knowledge more adoption*	More knowledge more adoption*
Empathy index (Can take others' roles)	More empathy more adoption	More empathy more adoption*
Secular orientation (Attitudes toward disease , cows and caste)	More secular more adoption	More secular more adoption*
Educational aspirations for youngest son	Higher aspirations more adoption	Higher aspirations more adoption*
Planning orientation (Does or does not plan for changes)	More likely to have adopted if changes are planned*	More likely to have adopted if changes are planned*

* Significant at the .01 level of probability, two-tailed test for chi-square or for \underline{g} .

Cultivators who had more knowledge of political figures were more apt to have adopted HYV. Respondents were asked to identify by name the Prime Minister of India, the Chief Minister of the state and the elected representative to the state legislature of the area in which the respondent lived. Political knowledge reflects on orientation to the larger society beyond the village and this in turn is likely to predispose greater acceptance of new practices.

Our next variable in Table 10 is empathy, defined as the ability to take others' roles. Empathic persons have been shown to be more favorable to change and to the adoption of new ideas and practices.¹⁴ Cultivators with more empathy, who could assume the roles we asked about, were more likely to have adopted HYV. Like political knowledge, empathy describes a respondent in terms of his awareness of the world about him.

The third variable in Table 10 is secular orientation, measured by a series of questions about attitudes toward disease, cows and caste.¹⁵ The more secularly oriented cultivators were more apt to have adopted HYV.

We also considered educational aspirations which cultivators had for their youngest son and found that those who had higher aspirations were more apt to have adopted HYV.

Our last social-psychological variable was one we called "planning orientation", measured by asking the respondent if he planned any changes on his farm in the next two or three years. We considered that an affirmative answer would indicate an orientation toward the future. Cultivators who planned changes were more apt to have adopted HYV.¹⁶ Like secularism, educational aspirations, empathy and political knowledge, planning orientation is one of the characteristics which denote a rational rather than a traditional approach to agriculture.

SUMMARY AND CONCLUSIONS

We have presented findings on the adoption of high yielding varieties (HYV) of seeds by 209 cultivators in three villages of Andhra Pradesh. Data for this study were part of a larger study of 680 cultivators in eight villages of Andhra Pradesh, Maharashtra and West Bengal.

We also compared the association of various independent variables and the adoption of HYV (by the 209 cultivators of Andhra Pradesh) with the association of the same independent variables and the adoption of ten agricultural practices (by the 680 cultivators in the three state sample). This comparison showed that general adoption research findings can be assumed to hold for the crucial specific innovation of HYV.

The sample was restricted to farmers who were not over 50 years of age and who were farming at least 2.5 acres of land. "Ever used a high yielding variety" was used as the dependent variable and measure of adoption of HYV. There were 55 cultivators who had adopted HYV and 154 who had not adopted HYV.

Adopters of HYV were significantly more apt to have purchased higher amounts of fertilizer. Adopters were somewhat less apt to report difficulty in obtaining fertilizer, and were somewhat more likely to have reported interest in further purchases, but these relationships were not significant. Only 15 per cent of all 209 cultivators, both adopters

and non-adopters, had used no fertilizer in 1966. Most of the 209 cultivators reported difficulty in obtaining fertilizer but a little less than half said they would have bought more fertilizer had it been available.

None of the three credit factors we investigated was significantly related to adoption of HYV. About two-thirds of the adopters and two-thirds of the non-adopters of HYV had used some credit in the year prior to the interview. Over 20 per cent of adopters and non-adopters combined reported difficulty in obtaining credit. About 75 per cent said they would have used more credit had it been available.

Our investigation of communication channel use by adopters of HYV showed a striking influence of change agents such as VLW and BDO, both as a source of first information for HYV and as a source of information leading to trial of HYV. Change agents were also important communication channels of information for non-adopters of HYV but personal sources of information such as friends and relatives were somewhat more important. The mass media were more important for first information than for information leading to trial of HYV, and they were more important for adopters than for non-adopters. However, the relative influence of mass media on adoption of HYV seemed to be slight in our sample.

We investigated the credibility to cultivators of four sources of information which might induce them to try HYV.

Cultivators clearly placed most reliance upon demonstrations. Radio broadcasts were given least credibility, with neighbors and VLW having intermediate positions.

Adoption of HYV was strongly and positively associated with adoption of ten agricultural practices, of which HYV was one. Furthermore, relationships between adoption of HYV and some 28 independent or explanatory variables were in almost all cases similar to those between these same independent variables and adoption of ten agricultural practices. This similarity of findings lends much support to the relevance of general diffusion research for the currently critical interest in HYV.

Size of farm, degree of commercialization, and number of different crops sold were significantly and positively associated with adoption of HYV. Farm efficiency and degree of farm ownership were positively but not significantly associated with adoption of HYV.

Adopters of HYV tended to be those with a higher ritual caste rank, those who were literate and had more years of schooling, those who had a higher level of living, and those who participated more in formal organizations.

Similarly, adopters of HYV were more apt to read newspapers, to attend commercial cinemas, to listen^{to}/radio farm forums and news broadcasts, and to visit a town or city.

Various measures of extension knowledge and contact were all positively associated with adoption of HYV. We took these findings as strong evidence that extension efforts are producing results and that these efforts should be selectively intensified.

Adopters of HYV were likely to have more knowledge of political figures, could empathize more readily, were more secular, had higher educational aspirations for their son, and were more likely to have planned future changes for their farm business. We interpreted this set of characteristics as denoting a rational father than traditional approach to agriculture.

We have offered some conclusions in previous sections of this report. We will now repeat some of these and draw conclusions of a general nature.

1. There is little question but that the general findings of research on the diffusion of innovations can be assumed to hold for the specific innovation of HYV. Despite substantial differences in sub-samples there was a remarkable similarity between the findings of our study on adoption of HYV and the findings of our larger study of adoption of ten agricultural practices. This similarity is important because there is a large and growing body of research on diffusion of innovations which can be tapped for guidance in constructing and implementing programmes of change.

2. As quickly as possible, an adequate supply of fertilizer and credit should be made available to commercial cultivators. Most of the cultivators in our study sample indicated difficulty in obtaining these two resources. An increase in credit facilities, in particular, should be possible through creative and imaginative planning at all levels of banking procedures. It is likely that present arrangements for securing loans for cultivators are unduly cumbersome and restrictive. An increase in the supply of fertilizer is more dependent upon natural resources and available physical plant. The present rapid growth of the fertilizer industry is likely to be matched by a rising demand for fertilizer because of the ability of HYV to respond to heavy applications.

3. It was observed that cultivators on the larger size farms were more apt to adopt HYV. This is probably because of a greater capacity for financial investment and a greater ability to take the high risks sometimes associated with HYV. Therefore, extension efforts to increase use of HYV should at first be concentrated on cultivators with larger size farms. Such cultivators, of course, also have a greater capacity for agricultural production.

4. Extension efforts to promote HYV should be selectively intensified. This means that the training of VLWs and other agricultural workers should be improved so as to

keep up with the increasing complexity of problems involved in using HYV. It also means that numbers of extension workers should be increased where the prospect of increased commercial production via HYV exists. Both in the present study of HYV and in the larger studies of our project, the evidence of the importance of extension personnel in adoption behaviour was unequivocal. Yet, there is much scope for increased adoption - only 55 of 209 cultivators had adopted HYV. The opportunity exists for extension personnel to make "the new strategy" of HYV a truly successful one.

5. The influence of mass media upon knowledge and adoption of HYV was considerably less than that of change agents. However, we found that the mass media were quite important in the larger studies of our project. In the HYV study sample, levels of newspaper reading were quite high and over 90 per cent reported that they listen to the radio. There is a large target audience which could be reached by the mass media. It will take well-planned and relevant promotional material to tap this audience.

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FOOTNOTES

1. Government of India, Fourth Five Year Plan: A Draft outline, New Delhi: Planning Commission, 1966, p. 175.
2. This larger study, in turn, was part of an international research project entitled "Diffusion of Innovations in Rural Societies", E.M. Rogers, Director, Department of Communication, Michigan State University, under contract with the United States Agency for International Development. The project included three countries, Brazil, India and Nigeria. The Indian part of the study was conducted in collaboration with the National Institute of Community Development, Hyderabad, A.P., India. Phases 1, 2 and 3 of our study are reported in F.C. Fliegel, P. Roy, L.K. Sen and J.E. Kivlin, Agricultural Innovations in Indian Villages, P. Roy, F.C. Fliegel, J.E. Kivlin and L.K. Sen, Agricultural Innovation Among Indian Farmers, and J.E. Kivlin, P. Roy, F.C. Fliegel and L.K. Sen, Communication in India: Experiments in Introducing Change. Hyderabad: National Institute of Community Development, 1968. In addition, there are several special reports like the present report on high yielding varieties.
3. The Intensive Agricultural District Programme is popularly called "package programme". The package concept envisages the supply and use of all inputs necessary for maximum agricultural production. Package programmes, located in

one district of each participating state, have been implemented in areas with good natural resources and a high production potential.

4. The study of HYV was carried out only in Andhra Pradesh because all but four of the respondents in the larger study who had ever used HYV were in that state. Knowledge of HYV (jowar and rice varieties) was fairly widespread, however. There were 451 cultivators, or 66 per cent of the 680 cultivators in the three state, larger study, who knew about HYV. All but seven of the 209 cultivators from Andhra Pradesh knew about HYV.
5. For a discussion of the dependent variable in Phase 2 of the larger study see P. Roy et al, Agricultural innovations ..., op. cit., Ch.2.
6. For a trenchant and provocative discussion of credit use orientation in our larger study, see Ibid., Pp. 113-115.
7. See E.M. Rogers, Diffusion of Innovations, New York: The Free Press of Glencoe, 1962, Ch.4.
8. The practices were use of HYV, ammonium sulphate, superphosphate, fertilizer mixtures, insecticides, green manuring, cultivator (implement), improved breeding of cattle, animal inoculation and rat poison. A description of these practices and detailed findings on the relationships of the ten item adoption index with various independent variables are given in P. Roy et al, Agricultural Innovation ..., op. cit.

9. We recognize that there is some circularity involved here. That is, part of the very strong relationship between adoption of HYV and adoption of ten agricultural practices is attributable to the fact that HYV was one of those ten agricultural practices.
10. Caste rankings were obtained by asking knowledgeable persons in each village to rank photographs of people at work in caste occupations in terms of ritual status for that village. Ritual status was defined on the basis of inter-dining and sharing of water. Later, the separate rankings for the study villages were standardized and combined into a single rank order.
11. Level of living was measured by an index composed of material possessions such as torch, bicycle or timepiece, and housing features such as the number of rooms. Items were scored 0 - 1 and summed.
12. Each name and position known, of two agricultural, two health and two family planning workers, was scored one point for a maximum theoretical score of 12.
13. This index was composed of four items which were differentially weighted so as to conform to an eight point scale. The item scores were then summed to make the index, which had a maximum theoretical score of 32. The items were 1) number of times talked with the BDO 2) number of times talked with the VLW 3) number of agricultural demonstrations seen and 4) number of times a block film was seen.

14. Roy et al, Agricultural Innovation ..., op. cit., and D. Lerner, The Passing of Traditional Society, New York: The Free Press of Glencoe, First Paperback Edition, 1964, Pp. 70-72.
15. The questions were: (1) should Harijans (untouchables) be allowed to draw water from all common wells in the village; (2) should Harijans and other children take meals together in schools; (3) can evil eye cause disease; (4) do you think Harijans should be allowed to enter and worship in all temples of the village; (5) what do you do with bullocks who are too old to work; (6) should non-Hindus be allowed to eat beef; (7) if your son wanted to marry a lower caste girl, would you allow it; (8) in your opinion, is an illiterate village Brahmin superior to a lower caste college graduate.
16. We suspected that planning orientation might be a function of size of farm, with cultivators on larger farms perforce more apt to plan changes, but this was not the case. Planning orientation was not significantly associated with farm size (value of agricultural products raised).

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DIFFUSION OF INNOVATIONS RESEARCH REPORTS

Published

1. Bibliography of Research on the Diffusion of Innovations, 1964*
2. Opinion Leadership in Traditional and Modern Columbian Peasant Communities, 1964.
3. Bibliography on the Diffusion of Innovations, 1965.*
4. Bibliography on the Diffusion of Innovations, 1966.*
5. Achievement Motivation Among Columbian Peasants, 1966.
6. Bibliography on the Diffusion of Innovations, ,1967.
7. Innovation in Brazil: Success and Failure of Agricultural Programs in 76 Minas Gerais Communities.
9. Innovation in India: The Success or Failure of Agricultural Development Programs in 108 Indian Villages.
12. Patterns of Agricultural Diffusion in Rural India.
15. Communication in India: Experiments in Introducing Change.
18. Correlates of Family Planning in Eight Indian Villages.
19. Adoption of High Yielding Varieties in Three Indian Villages.
20. Development and Change in a Bengal Village.

Forthcoming

8. Innovation in Eastern Nigeria: Success and Failure of Agricultural Programs in 71 Villages.**
10. Patterns of Diffusion in Rural Brazil.
11. Patterns of Diffusion in Rural Eastern Nigeria.
13. Communication in Brazil: Experiments in Introducing Change.
14. Communication in Eastern Nigeria: Experiments in Introducing Change.
16. Survey Research in Developing Nations.
17. Comunicacao de Novas Ideas: Pesquisas Aplicaves Brazil.

TECHNICAL REPORTS (Published)

Technical Report 1: Empathy, Mass Media, and Modernization in Rural Brazil.

Technical Report 2: Communication Structure and Innovations Diffusion in Two Indian Villages.

Technical Report 3: Literacy Training and Modernization: A Field Experiment.

*No longer available.

**Titles may change slightly. The report can be requested by number, however, from Department of Communication, Michigan State University, East Lansing Michigan 48823, USA.