Aspects of the Training and Visit System of Agricultural Extension in India
A Comparative Analysis
Gershon Feder
Roger Slade

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A Comparative Analysis

Gershon Feder
Roger Slade

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The paper utilizes recent farm survey data to assess the performance of the Training and Visit Extension system in one district in the state of Haryana (India) compared to a neighboring district covered by an older extension system. The data show a significantly higher level of village-level extension activity in the area covered by Training and Visit Extension, and this is compatible with the larger number of staff and higher expenditure on extension under this system. The data also suggest that knowledge of improved practices, especially in wheat cultivation, diffused faster in the area covered by T&V extension.
En este trabajo se usan datos obtenidos mediante una encuesta en las fincas para determinar los resultados del sistema de extensión de capacitación y visitas en un distrito del estado de Haryana (India), en comparación con un distrito vecino en que funciona un sistema de extensión más antiguo. Los datos indican que en la región en que existe el sistema de capacitación y visitas las actividades de extensión al nivel de los poblados son mucho más amplias, lo que está en consonancia con el personal más numeroso y los gastos mayores en extensión que caracterizan a este sistema. Los datos también parecen indicar que el conocimiento de prácticas perfeccionadas, especialmente en lo que respecta al cultivo del trigo, se difunde más rápidamente en la zona en que se aplica el sistema de capacitación y visitas.

Le présent document utilise les données d’une récente enquête sur les exploitations agricoles pour comparer les résultats du système de vulgarisation fondé sur la formation et les visites, appliqué dans une circonscription de l’Etat de l’Haryana (Inde), et les résultats obtenus dans une circonscription voisine où est utilisé un système de vulgarisation plus ancien. Ces données indiquent que les activités de vulgarisation, au niveau du village, sont beaucoup plus intenses dans la zone couverte par le système de formation et visites, ce qui justifie les effectifs plus nombreux et les coûts plus élevés du nouveau système. Les informations recueillies suggèrent, d’autre part, que les populations sont plus vite au courant des techniques agricoles améliorées dans la zone où est appliqué le système de formation et visites, particulièrement pour la culture du blé.
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1. Introduction

Agricultural extension has a long history in India as in other countries. Since the mid-seventies, however, India has progressively replaced its system of multi-purpose field workers by the Training and Visit System of Agricultural Extension [Benor and Harrison, 1977]. This transition, not yet complete, has aroused widespread interest and spawned a growing body of literature; see for example, [Cernea 1981], [Howell 1982a, 1982b, 1983], [Von Blanckenburg 1982], [Jaiswal 1983], [Singh 1983], [Moore 1983], [Feder and Slade 1984a, 1984b]. Some of these, and other writers, see advantages in this new system of extension whilst others have expressed critical views. The resulting arguments, in the absence of suitable empirical evidence, proceed by anecdote and casual empiricism. Nevertheless, few authors fail to mention the need for objective empirical information [for example, Moore 1983] with which the effects of the training and visit system (hereafter T&V system) can be assessed. This need led, in late 1981, to the initiation of an intensive case study of the impact of T&V extension in the state of Haryana, where the extension system was reorganized in 1979. The study is being undertaken by the authors in collaboration with the Haryana Agricultural University at Hissar, and is designed inter alia to assess the extent to which the introduction of T&V extension in Haryana has accelerated the diffusion of knowledge about improved farming practices and increased farm productivity.
Data were collected through a series of sample surveys, spanning four consecutive crop seasons in two districts in Haryana (Jind and Karnal) and two crop seasons for one district in the neighboring state of Uttar Pradesh (Muzafarnagar). In Jind and Karnal districts two random samples, consisting of nearly equal numbers of contact and non-contact farmers, were chosen. In Muzafarnagar district and because the T&V system does not operate there, the sample comprised non-contact farmers only (see Table 1). Respondents were interviewed twice in each season. The first interview took place roughly at the mid-point of the season and the second shortly after the harvest. Respondents were constantly assured that the surveys were unconnected with the extension system or any other government department.

Table 1: COMPOSITION OF THE SAMPLE IN 1981

<table>
<thead>
<tr>
<th></th>
<th>Haryana</th>
<th>Uttar Pradesh</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Jind District</td>
<td>Karnal District</td>
</tr>
<tr>
<td>Contact Farmers</td>
<td>260</td>
<td>175</td>
</tr>
<tr>
<td>Non-Contact Farmers</td>
<td>345</td>
<td>200</td>
</tr>
<tr>
<td>Total</td>
<td>605</td>
<td>375</td>
</tr>
</tbody>
</table>

/a In subsequent parts of this paper, the number of observations records the number of valid responses for the relevant variable obtained from this sample. Also note that the numbers given in this table do not always constitute the denominator for the calculation of proportions, as sample fatigue and a few missed interviews changed the maximum possible sample size in each survey round.

Because the district of Jind is much drier than both Karnal and Muzafarnagar, comparative analysis in this paper is confined to the latter two districts and spans the two growing seasons, Rabi and Kharif of 1982/83, for which comparable data are available. Furthermore, we focus only on the
principal crop in each season -- paddy in the kharif (rainy season) and wheat in the rabi (dry season).

The paper is organized as follows; the next section contains an outline of the study area and descriptions of the two different systems of extension to be found there. In section three, based on characteristics that describe them, groups of farmers in the study area are compared. The following section briefly examines the role and selection of contact farmers in the T&V system. Data on the number and regularity of extension agent's visits to farmers are used in section five to examine the performance of the extension systems. Farmers' stated preferences concerning sources of information are also discussed. Subsequently, in section six, farmers' knowledge about a variety of recommended farming practices is reviewed and a comparative analysis is undertaken of the rates of knowledge diffusion for selected HYV paddy and wheat practices. The paper ends with a short summary and some conclusions.

2. The Districts Studied

Karnal and Muzafarnagar districts are similar in many respects. They lie on opposite banks of the Jamuna river, are flat, have similar light alluvial soils and are connected by a solitary bridge which spans the river some distance to the north. Average annual rainfall in Karnal is 803 mm and in Muzafarnagar 794 mm. Both districts are heavily irrigated: in Karnal 74 percent of the net cropped area is irrigated, the comparable figure for
Muzafarnagar is 84 percent. The two districts are linguistically and ethnically similar. In the Rabi season wheat is the dominant crop in both districts. In the Kharif, however, paddy is the major crop in Karnal, sugarcane being of lesser importance. In Muzafarnagar sugarcane is the preponderant Kharif crop and paddy is of secondary importance.

In the state of Uttar Pradesh, of which Muzafarnagar is the most westerly district, the extension system remains unreformed and is based on a network of village level workers (VLW) administered by the Community Development Programme. These workers are responsible not only for the provision of extension advice but regulate the supply of inputs and credit and provide links with the rural population for several other government agencies. There are some 155 VLW's in the district: one worker for every 5.9 villages. In Karnal the ratio is 4.7. Alternatively, in 1981 there were was one village extension worker (VEW) for every 7,400 members of the rural population in Karnal and in Muzafarnagar one VLW for every 11,500 rural people. These VLW’s are supplemented by staff of the Department of Agriculture who, working mainly under the aegis of a series of special crop programmes, are much concerned with the supply of farm inputs and the administration of specific subsidy and incentive schemes.

The T&V system is a hierarchically organized and time bound method of managing extension and is designed to deliver selected, timely and feasible technology to farmers with strict regularity. The technology is encapsulated in carefully formulated recommendations often termed impact points which extension agents convey to selected contact farmers (about 10 percent of all
farmers) and such other farmers as attend the fortnightly visits or who approach the agent on their own initiative at other times. The system places great emphasis on a professional approach to extension and requires an exclusive devotion to extension work. In principle, all activities related to the physical handling of inputs and credit applications should be strictly avoided. Extension agents are however expected to liaise with input supply agencies and to advise farmers on sources of supply.

In Haryana, of which Karnal is one of twelve districts, the extension system was reformed along T&V lines starting in December 1979. By August 1981, 95 percent of village extension worker (VEW) positions were filled as well as 79 percent of the subject matter specialist positions (technical specialists of intermediate rank). By March 1983 these figures had increased to 99 percent and 88 percent respectively. However, in May 1982 25 percent of agricultural extension officer positions (AEO's) were still vacant and were not filled until April 1983. District Technical Committees, Zonal Workshops, and the State Technical Committee were either not convened or worked erratically until very recently. These bodies, have, inter alia, important functions related to defining and programming technical recommendations. Their prolonged ineffectiveness constituted an important weakness in the extension system throughout the period of study.

There have also been other problems. Between early 1980 and early 1984 there were six changes amongst the three most senior government servants responsible for the T&V system in Haryana and this resulted in periodic and marked fluctuations in the strength of managerial commitment to the reformed
system. There were also widespread and disruptive staff transfers at the AEO and VEW levels during 1982.

In Karnal (and other districts) older VEWs have complained of reduced responsibility consequent on the separation of extension work from other agricultural duties. Some farmers have complained about their inability to obtain inputs through the VEW, supervising officers have been criticized for a lack of attention to field work and both VEW's and more senior officers still devote time to non-extension duties. The links between extension staff and the agricultural university remain weak, researchers continue to be isolated, and VEW training is poorly planned and frequently ineffective. [Sisodia 1983], [Hoepper 1983].

3. Some Characteristics of Farmers in the Study Area

Information on a dozen factors that are likely to influence farmers' receptivity to innovations is summarized in Table 2. These data provide a backdrop for the later comparative analysis between districts and allow the extent of similarities and differences between contact and non-contact farmers to be assessed. Critics of the T&V system frequently argue that contact farmers are chosen from amongst the wealthy and powerful, who then monopolize extension services at the expense of other less privileged farmers [Howell 1982a], [Moore 1983].
Table 2: Kharif 1982: CHARACTERISTICS OF SAMPLE FARMERS

<table>
<thead>
<tr>
<th>Farmer Characteristic</th>
<th>Karnal District (Haryana)</th>
<th>Non-Farm Class a/</th>
<th>Muzafarnagar District (Uttar Pradesh)</th>
<th>All Farmers (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taken Ag. Training Course</td>
<td>Small</td>
<td>6</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Large</td>
<td>12</td>
<td>2</td>
<td>2</td>
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<tr>
<td></td>
<td>All</td>
<td>10</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Participant in Village Govt.</td>
<td>Small</td>
<td>12</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Large</td>
<td>14</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>14</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>Has Non-Farm Employment</td>
<td>Small</td>
<td>21</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Large</td>
<td>23</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>22</td>
<td>27</td>
<td></td>
</tr>
<tr>
<td>Owns Tubewell</td>
<td>Small</td>
<td>91</td>
<td>59</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Large</td>
<td>98</td>
<td>91</td>
<td></td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>95</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>Owns Tractor</td>
<td>Small</td>
<td>8</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Large</td>
<td>63</td>
<td>63</td>
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<td></td>
<td>All</td>
<td>42</td>
<td>40</td>
<td></td>
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<tr>
<td>More Than 70 Percent of Land</td>
<td>Small</td>
<td>79</td>
<td>83</td>
<td></td>
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<tr>
<td></td>
<td>Large</td>
<td>74</td>
<td>89</td>
<td></td>
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<tr>
<td></td>
<td>All</td>
<td>76</td>
<td>86</td>
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<tr>
<td>Household Head</td>
<td>Small</td>
<td>50</td>
<td>70</td>
<td></td>
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<tr>
<td></td>
<td>Large</td>
<td>42</td>
<td>50</td>
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<tr>
<td></td>
<td>All</td>
<td>46</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Reporting b/ Salinity</td>
<td>Small</td>
<td>21</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Large</td>
<td>11</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>15</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>Reporting b/ Waterlogging</td>
<td>Small</td>
<td>5</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Large</td>
<td>7</td>
<td>17</td>
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<tr>
<td></td>
<td>All</td>
<td>6</td>
<td>15</td>
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<tr>
<td>Reporting a Shortage of Credit</td>
<td>Small</td>
<td>8</td>
<td>9</td>
<td></td>
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<tr>
<td></td>
<td>Large</td>
<td>4</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>6</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Reporting</td>
<td>Small</td>
<td>10</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Irregular Diesel Supplies</td>
<td>Large</td>
<td>18</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>13</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Reporting</td>
<td>Small</td>
<td>59</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Irregular Electricity Supplies</td>
<td>Large</td>
<td>68</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>64</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

Number of Observations

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<th>Large</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>66</td>
<td>111</td>
<td>177</td>
</tr>
<tr>
<td>Large</td>
<td>88</td>
<td>71</td>
<td>159</td>
</tr>
</tbody>
</table>

a/ Based on owned land. In this and subsequent tables, farmers owning 10 or more acres are defined as large farmers.

b/ Based on responses from paddy growers only. In Muzafarnagar District there were 56 such respondents.
In Karnal, contact farmers are significantly more involved in village government and have participated more frequently in agricultural training courses than non-contact farmers, although the difference in the latter attribute is not statistically significant. Whilst the participation of farmers in agricultural training in Muzaffarnagar is less than for non-contact farmers in Karnal, their involvement in village government appears to be more widespread -- a difference that is statistically significant. Presumably, this reflects a somewhat more diversified social structure in Muzaffarnagar district.

The proportion of farmers who also have non-farm employment, a characteristic that may affect their attitudes to production risk, is significantly greater in Muzaffarnagar than among non-contact farmers in Karnal. The difference between contact and non-contact farmers in Karnal is not statistically significant.

The ownership of tubewells is significantly higher for contact farmers in comparison to non-contact farmers in Karnal although the absolute levels of ownership for both groups are high. Generally, tubewell ownership is more common among large farmers than among small farmers. The ownership pattern of tubewells in Muzaffarnagar is very similar to that of non-contact farmers in Karnal and enhances the validity of comparisons between these groups. In the same way the extent of irrigation is very similar amongst non-contact farmers in Muzaffarnagar and non-contact farmers in Karnal. Table 2 also presents data on the incidence of waterlogging and salinity and
clearly shows, consistent with the higher proportion of irrigated land in the extreme west of Uttar Pradesh, that the incidence of both problems is significantly higher in Muzafarnagar than amongst non-contact farmers in Karnal.

Comparisons of the frequency with which heads of household are found to have no formal education reveal that contact farmers are significantly better educated than non-contact farmers in Karnal but that the difference between farmers in Muzafarnagar and non-contact farmers in Karnal is not significant. Credit is not an overriding constraint for any group of farmers. Problems with power supplies (diesel fuel or electricity) for irrigation facilities are serious in Karnal and in this respect farmers in Muzafarnagar seem to be much better provided.

In general we conclude that while non-contact farmers in Karnal are not identical to farmers in Muzafarnagar, they are comparable as there is no clear dominance of one group over the other with respect to factors likely to influence their attitudes to innovations.

4. The Selection and Characteristics of Contact Farmers

At the bottom of the T&V system hierarchy are the village extension agents, who cover areas typically containing 700-800 farming families, divided into about eight groups. In each group, about 10 percent of the farmers are selected as "contact farmers" by the local VEW who visits each of the eight farmers' groups once every two weeks, on a pre-specified and fixed date. These visits are mostly to contact farmers, but other farmers are expected to participate. Indeed, the T&V method stresses that non-contact
farmers must not be excluded from meetings between the VEW and contact farmers and that they should be made aware of the extension agents' regular visits to the group (or the village) and of their freedom to attend meetings. They should be encouraged to attend visits by extension agents in contact farmers' fields, and their queries should be answered (Benor, personal communication). Indeed, as we show later, non-contact farmers do report significant direct exposure to extension.

Contact farmers are expected to act as opinion leaders. They receive a continuous and regular flow of information from extension agents which they are expected to convey to other farmers. It follows that the way in which they are selected is a matter of considerable importance. While their potential for opinion leadership on matters of crop husbandry is the key criterion, they should not be exceptional in their command of resources lest other farmers fail to imitate them, attributing their achievements to their wealth not to the application of improved practices [Benor and Harrison, 1977], [Benor and Baxter 1984]. Hence a fine balance must be maintained between "representativeness" and potential for opinion leadership. Since the latter is closely related to innovativeness [Kivlin et al., 1971: pp 155–160], there is an obvious trade-off between choosing those farmers who will adopt innovations most speedily and those who are somewhat less suitable (from the point of view of potential for fast adoption), but whose resource position is typical of the majority of farmers and hence, their behavior more readily imitated.
Since each VEW is responsible for the selection of contact farmers in his area personal preferences cannot be totally eliminated, and experience has shown that agents in many extension systems tend to favor the wealthy and influential. Further, the extent to which the principles of contact farmer selection embodied in the T&V credo are applied, will vary according to the extent to which VEW's understand the system and have benefitted from orientation training. Hoepper [1983] has shown that there is considerable variation in the application of selection criteria by VEW's. It is not, therefore, surprising that in some respects contact farmers are representative of the farming community as a whole, while in other ways they are significantly different. Feder and Slade [1984a] demonstrate this point using multivariate logit analysis and show that while the caste composition of two groups of contact and non-contact farmers is almost identical farmers who are wealthier, more educated, more favorably endowed with irrigation facilities and of higher social status than the majority are more frequently selected as contact farmers. They also note, however, that although very small farmers (those owning less than two acres) were underrepresented in the contact farmer group, their share was not negligible – 12 percent compared to 30 percent in the general population.

5. Aspects of Extension Operations

As noted above, T&V extension is a hierarchical and time bound system which requires extension agents to perform their duties in a regular and predictable manner. The essence is a two weekly visit by the VEW to each farmer group in his domain. During these visits, the VEW focuses mainly,
but not exclusively on the contact farmers. As the system becomes established and a regular pattern of visits is built up so an increasing number of non-contact farmers are expected, through normal diffusion, to first become aware of the availability of regular extension advice and second to attend meetings between the VEW and contact farmers.

In any four-week period, under ideal conditions, most contact farmers should report two visits. Such ideal conditions do not obtain in reality for various reasons: an extension agent may be temporarily sick for the whole or part of the reference period, some areas may be temporarily unattended due to unfilled vacancies, some farmers may skip a visit due to their own considerations and some VEW’s may be dilatory. These factors may be summed up as normal friction. Nevertheless, if the system is working well the vast majority of contact farmers should receive two visits in each four-week period. Obviously, the same is not true of non-contact farmers but it might reasonably be expected that a slowly growing number of non-contact farmers will receive some direct advice from extension agents.

Table 3 summarizes the evidence over four seasons in Karnal. By kharif 1981 after about two years of T&V operations about 80 percent of contact farmers received at least one visit during the four weeks studied but only a little more than 60 percent received two visits. Alternatively, about 20 percent did not receive any visits and nearly 40 percent received less than two visits. This is probably more than can be accounted for by normal friction. By Rabi 1982/83 the situation had improved slightly so that 30 percent of contact farmers received less than their scheduled two visits.
<table>
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</thead>
<tbody>
<tr>
<td></td>
<td>Contact Farmers</td>
<td>Non-Contact Farmers</td>
<td>All Farmers</td>
<td>Contact Farmers</td>
<td>Non-Contact Farmers</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>No. Observations</td>
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<td>No. Observations</td>
<td>Number of Visits</td>
<td>No. Observations</td>
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<td>64</td>
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<tr>
<td>All</td>
<td>175</td>
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<td>111</td>
<td>20</td>
<td>25</td>
<td>65</td>
<td></td>
<td>71</td>
<td>83</td>
</tr>
<tr>
<td>All</td>
<td>177</td>
<td>25</td>
<td>16</td>
<td>59</td>
<td></td>
<td>159</td>
<td>86</td>
</tr>
<tr>
<td>Small</td>
<td>59</td>
<td>15</td>
<td>13</td>
<td>72</td>
<td></td>
<td>93</td>
<td>77</td>
</tr>
<tr>
<td>Large</td>
<td>101</td>
<td>10</td>
<td>20</td>
<td>70</td>
<td></td>
<td>73</td>
<td>68</td>
</tr>
<tr>
<td>All</td>
<td>160</td>
<td>13</td>
<td>17</td>
<td>70</td>
<td></td>
<td>166</td>
<td>73</td>
</tr>
</tbody>
</table>

n.a. = not available.
During the intervening two seasons, however, the situation deteriorated substantially and it seems likely that this was a direct reflection of uncertainties that resulted from the changes that took place in senior extension management in Haryana at that time. There is also some evidence [Hoeper 1983] that the extensive transfers of field staff during 1982 disrupted visit schedules. During the kharif 1982 season, VEW visits to contact farmers were significantly biased in favour of the larger farmers but in the other seasons the apparent differences are not statistically significant.

The story for non-contact farmers is much the same, but at lower absolute levels of contact frequency. Although larger non-contact farmers report a higher incidence of interaction with extension staff only in Rabi 1981/82 is the difference statistically significant. What does stand out, however, is that, in comparison to the traditional system of extension operating in Muzafarnagar the T&V system achieves more direct contact with farmers. Comparisons of the figures for Karnal with those of Muzafarnagar show that the proportion of non-contact farmers in Karnal who had direct contact with the extension agent is significantly higher than the comparable proportion in Muzafarnagar. This is compatible with the lower farmer to extension agent ratio in an area covered by the T&V system relative to an area served by traditional, multi-purpose VLW's.

Data about extension visits is also reported in Table 4 but the reference period is extended to the entire season, excluding the four weeks immediately prior to the interview. A season long perspective helps to
eliminate the effects of any special circumstances that may have affected extension activities, or farmers recollection of them, in the month preceding the interview. The data show that during each of the four seasons covered by the surveys, 80 to 90 percent of all contact farmers were visited by their VEW, whilst about 10 percent were not visited at all. VEW’s are however, advised to replace contact farmers whom they find uncooperative or who are deemed unsuitable by other contact farmers. To avoid mutual loss of face (status) they do not formally 'dismiss' contact farmers but merely phase out their visits to them (Baxter personal communication).

The data in Table 4 provide no evidence of farm size bias in agents visits to contact farmers (the reported differences are not statistically significant) but amongst non-contact farmers, there is a consistent significant bias in favor of larger farmers. This, however, does not necessarily reflect a pre-disposition on the part of extension personnel, as non-contact farmers in their dealings with VEWs act primarily on their own initiative. Moreover, the theory of information acquisition predicts that larger farmers will be more inclined to actively seek information because the per-acre cost of obtaining information is lower for them than for smaller farmers [Feder and Slade 1984b]. Table 4 also shows that in Muzafarnagar, farmers' contact with extension agents is significantly less than in Karnal.
Table 4: PROPORTION OF FARMERS VISITED BY VEW DURING SEASON a/

<table>
<thead>
<tr>
<th>Season</th>
<th>Size</th>
<th>Farm No: Observations</th>
<th>Percent Visited</th>
<th>Sample Size</th>
<th>Percent Visited</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kharif</td>
<td>Small</td>
<td>63</td>
<td>80</td>
<td>114</td>
<td>45</td>
</tr>
<tr>
<td>1981</td>
<td>Large</td>
<td>112</td>
<td>86</td>
<td>85</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>175</td>
<td>83</td>
<td>199</td>
<td>51</td>
</tr>
<tr>
<td>Rabi</td>
<td>Small</td>
<td>70</td>
<td>83</td>
<td>105</td>
<td>11</td>
</tr>
<tr>
<td>1981/82</td>
<td>Large</td>
<td>110</td>
<td>86</td>
<td>79</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>180</td>
<td>85</td>
<td>184</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kharif</td>
<td>Small</td>
<td>66</td>
<td>86</td>
<td>88</td>
<td>31</td>
</tr>
<tr>
<td>1982</td>
<td>Large</td>
<td>111</td>
<td>93</td>
<td>71</td>
<td>48</td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>177</td>
<td>91</td>
<td>159</td>
<td>38</td>
</tr>
<tr>
<td>Rabi</td>
<td>Small</td>
<td>59</td>
<td>81</td>
<td>93</td>
<td>20</td>
</tr>
<tr>
<td>1981/82</td>
<td>Large</td>
<td>101</td>
<td>89</td>
<td>73</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>160</td>
<td>86</td>
<td>166</td>
<td>26</td>
</tr>
</tbody>
</table>

n.a. = not available.

a/ Excluding the four weeks immediately before the interview. Only respondents who had received at least one visit from the VEW during the month before the interview were questioned.
The data in Table 5 record the extent to which farmers verify that extension visits take place on the appointed day and show that three-quarters of all contact farmers who have been visited during the season report visits to be regular and that a quarter report the reverse. In short, although the T&V system in the study area is not without flaws, it does reach the majority of contact farmers regularly and a substantial proportion of non-contact farmers less regularly. Furthermore, the data do not support the contention that T&V has atrophied leaving an empty structure and no change in extension operations [Jaiswal 1983]. On the contrary, even in unsettled times (1982) it appears that the mechanics of T&V operations, although sub-optimal, are still better than those of the traditional system. This of course, is as it should be given the greater number of staff employed.

Moore [1983], Jaiswal [1983] and other commentators have claimed, for many areas in India covered by the T&V system, that farmers perceive little benefit in the reformed system, that VEW’s are not known by their clients, that contact farmers fail to pass on information to others and may not even know that they are contact farmers. The data, reported below, for the study area in Haryana, do not support these contentions.

Out of an original sample of 192 contact farmers selected at random from the extension lists in Karnal district 175 turned out, on their own admission, to be contact farmers and most of the remainder claimed to have been contact farmers in the recent past.
Table 5: SEASONAL REGULARITY OF VEW VISITS AMONGST FARMERS RECEIVING A VISIT IN THE FOUR WEEKS PRIOR TO INTERVIEW a/

<table>
<thead>
<tr>
<th>Season</th>
<th>Farm Size</th>
<th>Karnal District, Haryana</th>
<th>Muzafarnagar District U.P.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Contact Farmers</td>
<td>Non-Contact Farmers</td>
<td>All Farmers</td>
</tr>
<tr>
<td></td>
<td>No. Observations b/</td>
<td>Percent Visited Regularly</td>
<td>No. Observations b/ Regularly</td>
</tr>
<tr>
<td>Kharif</td>
<td>Small</td>
<td>49</td>
<td>59</td>
</tr>
<tr>
<td>1981</td>
<td>Large</td>
<td>93</td>
<td>71</td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>142</td>
<td>67</td>
</tr>
<tr>
<td></td>
<td></td>
<td>n.a.</td>
<td></td>
</tr>
<tr>
<td>Rabi</td>
<td>Small</td>
<td>51</td>
<td>71</td>
</tr>
<tr>
<td>1981/82</td>
<td>Large</td>
<td>91</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>142</td>
<td>73</td>
</tr>
<tr>
<td></td>
<td></td>
<td>n.a.</td>
<td></td>
</tr>
<tr>
<td>Kharif</td>
<td>Small</td>
<td>44</td>
<td>73</td>
</tr>
<tr>
<td>1982</td>
<td>Large</td>
<td>89</td>
<td>84</td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>133</td>
<td>81</td>
</tr>
<tr>
<td>Rabi</td>
<td>Small</td>
<td>50</td>
<td>82</td>
</tr>
<tr>
<td>1981/82</td>
<td>Large</td>
<td>90</td>
<td>71</td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>140</td>
<td>75</td>
</tr>
</tbody>
</table>

n.a. = not available.

a/ Regularity is defined as always receiving a visit on the same day of the week within each fortnight.

b/ Only respondents who received at least one visit during the four weeks prior to interview were questioned.
All farmers in the sample were asked if they had observed changes in the style of the extension system during the past few seasons as compared to several years ago. The results are recorded in Table 6. Predictably, no change was perceived in Muzafarnagar as no change took place. In Karnal almost all contact farmers were aware of a change in extension operations and they perceived the change to be beneficial. Amongst non-contact farmers less than half were similarly aware although the majority of those who noticed a change held positive opinions about it. Farmers were asked these questions in the kharif season of 1982 when, as noted above, field operations were unsettled. Nevertheless, awareness of the change amongst non-contact farmers, particularly small non-contact farmers is low and suggests that efforts to publicize the availability of extension advice have been unsuccessful.

Almost all contact farmers, and about half of the non-contact farmers know the VEW that visits their group (Table 7). The comparable proportion for Muzafarnagar is, however, a little more than one-tenth. Similarly, 60 percent of non-contact farmers reported knowing at least one contact farmer in their area.

Whilst it is not incumbent on contact farmers to pass on the knowledge gained from extension agents they are expected to do so. Relevant findings from the survey are reported in Table 8. It is clear that more than half of all contact farmers claimed to have discussed extension advice with other farmers, whilst more than 30 percent of those non-contact farmers
Table 6: KHARIF 1982: FARMERS' AWARENESS OF CHANGES IN EXTENSION OPERATIONS IN COMPARISON WITH PRE-1979 SYSTEM

<table>
<thead>
<tr>
<th>Response a/</th>
<th>Karnal District, Haryana</th>
<th>Muzafarnagar District, Uttar Pradesh</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Contact Farmers</td>
<td>Non-Contact Farmers</td>
</tr>
<tr>
<td></td>
<td>Small (N=59)</td>
<td>Large (N=101)</td>
</tr>
<tr>
<td>1. Not aware of change</td>
<td>5 2 3</td>
<td>67 48 38</td>
</tr>
<tr>
<td>2. Extension visits more frequent and regular</td>
<td>37 18 25</td>
<td>3 3 3</td>
</tr>
<tr>
<td>3. Extension delivers more useful and timely information</td>
<td>59 77 71</td>
<td>28 45 36</td>
</tr>
<tr>
<td>4. Extension visits are less frequent and less regular</td>
<td>12 11 11</td>
<td>2 7 4</td>
</tr>
<tr>
<td>5. Information is not as useful as before</td>
<td>0 0 0</td>
<td>0 0 0</td>
</tr>
</tbody>
</table>

\(a\) Responses 2-4 are not mutually exclusive.
Table 7: RABI 1982/83: KNOWLEDGE OF VEW BY FARMERS

<table>
<thead>
<tr>
<th>Farm Size</th>
<th>Karnal District, Haryana</th>
<th>Muzafarnagar District U.P.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Contact Farmers</td>
<td>Non-Contact Farmers</td>
</tr>
<tr>
<td></td>
<td>No. Observations</td>
<td>Percent Knowing VEW</td>
</tr>
<tr>
<td>Small</td>
<td>59</td>
<td>97</td>
</tr>
<tr>
<td>Large</td>
<td>101</td>
<td>98</td>
</tr>
<tr>
<td>All</td>
<td>160</td>
<td>98</td>
</tr>
</tbody>
</table>

a/ In this context 'Knowledge' was defined as knowing the name of the VEW or being able to recognize him.
who had direct contact with VEW's also claimed to have passed on information obtained from extension agents.

Table 8: KHARIF 1982: FARMERS WHO DISCUSSED EXTENSION ADVICE WITH OTHERS

<table>
<thead>
<tr>
<th>Farmer Type</th>
<th>Karnal District-Haryana</th>
<th>Muzafarnagar District - U. P.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of Observations</td>
<td>Discussed with Others (Percent)</td>
</tr>
<tr>
<td>Contact</td>
<td>149</td>
<td>52</td>
</tr>
<tr>
<td>Non-contact</td>
<td>52</td>
<td>37</td>
</tr>
</tbody>
</table>

Further evidence of farmer's opinions about extension is provided in Table 9 which reports farmers' rankings of their most important sources of information. Not surprisingly, perhaps, individual advice from the VEW was the first choice for the vast majority of contact farmers. Of greater interest is that nearly 20 percent of non-contact farmers in Karnal were of the same opinion compared to 2 percent in Muzafarnagar. Advice from other farmers scored highly in Karnal but was the dominant source in Muzafarnagar, perhaps reflecting the absence of an effective alternative. Of the remaining sources only radio programs won a noticeable number of first preferences. Indeed, it would appear that radio and, to a lesser extent, input salesmen and distributors are regarded as subsidiary rather than primary sources of information by farmers in both districts.

6. Aspects of Farmer Knowledge

An increase in farmers knowledge about crops and cropping practices is the intended direct product of extension. Obviously, those who seek to
### Table 9: RABI 1982/83: Farmers Sources of Information by Ranked Preference a.

<table>
<thead>
<tr>
<th>Source of Information</th>
<th>Ranked Preference</th>
<th>Karnal District, Haryana</th>
<th>Muzafarnagar District, U.P.</th>
<th>All Farmers: Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Contact Farmers</td>
<td>Non-Contact Farmers</td>
<td></td>
</tr>
<tr>
<td>Individual advice from VEW</td>
<td>First</td>
<td>87</td>
<td>19</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Second</td>
<td>1</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Third</td>
<td>1</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Advice from contact farmer</td>
<td>First</td>
<td>1</td>
<td>16</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Second</td>
<td>3</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Third</td>
<td>1</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Advice from other farmers b/</td>
<td>First</td>
<td>9</td>
<td>47</td>
<td>82</td>
</tr>
<tr>
<td></td>
<td>Second</td>
<td>36</td>
<td>33</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Third</td>
<td>21</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>Demonstration/field days</td>
<td>First</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Second</td>
<td>10</td>
<td>2</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>Third</td>
<td>3</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Agricultural radio programs</td>
<td>First</td>
<td>1</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Second</td>
<td>28</td>
<td>27</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>Third</td>
<td>39</td>
<td>34</td>
<td>32</td>
</tr>
<tr>
<td>Salesmen and agency officials</td>
<td>First</td>
<td>0</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Second</td>
<td>15</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>Third</td>
<td>18</td>
<td>21</td>
<td>17</td>
</tr>
<tr>
<td>Other c/</td>
<td>First</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Second</td>
<td>6</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Third</td>
<td>19</td>
<td>27</td>
<td>39</td>
</tr>
</tbody>
</table>

a/ For each source of information farmers were asked to say whether they regarded it as a primary, secondary or tertiary source.

b/ Other farmers could in fact be contact farmers. Not all contact farmers are known as such to the non-contact farmers.

c/ Includes group meetings, journals and other publications, and research personnel.
improve extension systems hope that additional knowledge will lead to the adoption of improved husbandry by cultivators and will ultimately be translated into increased agricultural productivity. Adoption and any resulting changes in output are, however, only indirectly affected by extension and the disentangling of the direct and indirect effects from other contributing factors is a complex task which we have, for the time being, chosen to eschew. Instead we concentrate on comparing levels of knowledge among the different groups of farmers. This has the advantage of avoiding issues such as constrained input supplies and credit availability which may affect adoption and productivity in a particular season. Such factors should not, however, affect the acquisition of knowledge. We confine our comparative analysis to data drawn from the survey in Karnal and Muzafarnagar during the Kharif and Rabi seasons of 1982/83.

The data in Table 9 show farmers preferences by information source and demonstrate that farmers acquire their knowledge from several sources amongst which the extension service and other farmers are the most important. Moreover, we tested farmers' sources of knowledge for a wide range of specific practices and found that for most practices not involving specialized technical knowledge or major expense, contact farmers, under the T&V system, learn mostly from the extension service whilst non-contact farmers learn mostly from other farmers, including contact farmers. With regard to practices involving specialized technical knowledge the picture was roughly reversed. For such practices all farmers tend to learn from knowledgeable primary sources, such as extension agents or other informed persons. This
apparently regular pattern suggests that the diffusion of knowledge regarding
the more demanding practices is likely to be much faster in an area such as
Karnal which has ample extension staff than in a less well endowed area such
as Muzafarnagar.

During the sample surveys farmers were also questioned on their
knowledge of specific practices and on the time when they first learned about
them. Knowledge is difficult to measure without conducting a thorough
examination of a respondents understanding of all aspects of a given recom-
mandation. For some practices this was possible but for others detailed
testing was beyond the time and resources available. In such cases, however,
it was possible to establish the farmers awareness of the practice. Such
awareness is an important indication of knowledge because, by definition a
farmer who is unaware of a practice cannot be familiar with its detail. From
the resulting data the levels of knowledge in 1978, the year before T&V
extension was introduced in Haryana, and 1982, four years later, have been
calculated. To increase the validity of comparisons between Karnal and
Muzafarnagar contact farmers in Karnal have been excluded from the analysis
because they receive a disproportionate amount of direct extension advice and
may also be different in other ways. Thus the results reported in Tables 10
and 11 are, for Karnal, based only on responses from non-contact farmers.

The direct comparison between Karnal and Muzafarnagar of the present
levels of knowledge about a practice is clearly an unsound procedure because
the initial or starting level of knowledge may differ for random or histori-
cal reasons. The proper procedure would be to compare the time paths of
knowledge diffusion by superimposing, for each practice in turn, the time path from the area with T&V extension on the corresponding time path from the area with traditional extension. If the former path lies above the latter it may be inferred that the more intensive extension effort provided by T&V increases the rate of knowledge diffusion.

However, with only two observations we have no clue as to the shape of the growth curve which passes through them. To assume that the growth path is linear is clearly wrong as it is widely believed that processes of diffusion follow a logistic curve or some other non-linear function of time. The growth path for a logistic curve can be calculated from the following equation;

\[
K_t = \frac{1}{1 + e^{a - \beta t}}
\]  

(1)

where \( K_t \) is the proportion of knowledgeable farmers, \( t \) is time and \( a \) and \( \beta \) are parameters.

Given, however, that we cannot be sure that a logistic curve will accurately reflect the growth path of knowledge for all practices we postulate that the growth path might alternatively be approximated by the following negative exponential function;

\[
K_t = 1 - (1 - K_0) \cdot e^{-\gamma t}
\]  

(2)

where \( K_t \) is again the proportion of knowledgeable farmers, \( t \) is time and \( \gamma \) a parameter.
Equation (2) represents a curve with a monotonically decreasing rate of growth and may be a good approximation where the initial or base observation is 50 percent or more, and therefore, above the inflection point in equation (1). Figure 1 below describes the slope of both curves.

![Figure 1. Logistic (a) and Negative Exponential (b) Curves](image)

The application of equations (1) or (2) to our data, although requiring strong implicit assumptions (the recorded rates of knowledge are, after all, estimates based on a sample of observations) does allow useful inferences to be made about the diffusion paths. And, it can be shown that the larger are the parameters \( \beta \) or \( \gamma \) the higher is the diffusion path (for any given initial level of knowledge) and hence the faster will a saturation level of knowledge (say 99 percent) be achieved. Now, the parameters of the functions derived from the observations for Muzafarnagar can be interpreted as the path that would have applied to Karnal if the T&V system had not been introduced. And, given that the farmers in the samples from the two districts are quite similar in most relevant respects except of course, for the extension system servicing them, we may interpret higher values for \( \beta \) or \( \gamma \) in
Karnal as a reflection of the contribution made by intensive extension to faster diffusion of knowledge. This procedure has the additional advantage of circumventing the problem posed by different initial levels of knowledge for the two districts.

To calculate the values of the parameters $\beta$ and $\gamma$ we re-write equations (1) and (2) as follows:

\[
\frac{\ln \frac{K_t}{1 - K_t} - \ln \frac{K_0}{1 - K_0}}{t} = \beta \quad (1a)
\]

\[
\frac{\ln (1 - K_0) - \ln (1 - K_t)}{t} = \gamma \quad (2a)
\]

where $K_0$ represents the proportion of knowledgeable farmers in the initial time period (1978).

The calculated values of $\beta$ and $\gamma$ are reported in Tables 10 and 11 for each practice in each district except in two cases. The first where the initial observation was zero and the second where the terminal observation was 100 percent. In such cases the formulae cannot be applied.

Of the ten HYV paddy practices (Table 10) only three practices in Karnal proved to have clearly superior estimated exponents in comparison with those for Muzafarnagar (practices 2, 7 and 9). Three other paddy practices (1, 4 and 10) show superior exponents for equation (2) but not for equation
Table 10: Kharif 1982, Parameters of Knowledge Diffusion Curves for Recommended HYV Paddy Practices Amongst Non-Contact Farmers in Karnal and All Farmers in Muzafarnagar

<table>
<thead>
<tr>
<th>Practice</th>
<th>Karnal District, Haryana</th>
<th>Muzafarnagar District, Uttar Pradesh</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Percentage Knowledgeable</td>
<td>Parameter (N=138) a/</td>
</tr>
<tr>
<td>1. Best Spacing</td>
<td>58</td>
<td>81</td>
</tr>
<tr>
<td>2. Number of Seedlings per Station</td>
<td>54</td>
<td>97</td>
</tr>
<tr>
<td>3. Chemical Treatment of Seed</td>
<td>23</td>
<td>29</td>
</tr>
<tr>
<td>5. Salt Treatment of Seed</td>
<td>12</td>
<td>14</td>
</tr>
<tr>
<td>6. Method of Nitrogen Application</td>
<td>62</td>
<td>78</td>
</tr>
<tr>
<td>7. Utility of Pesticides</td>
<td>22</td>
<td>41</td>
</tr>
<tr>
<td>8. Utility of Phosphate</td>
<td>51</td>
<td>73</td>
</tr>
<tr>
<td>10. Utility of Zinc Sulphate</td>
<td>49</td>
<td>75</td>
</tr>
</tbody>
</table>

Note: The asterisk (*) signifies what the parameter for Karnal is higher than the corresponding value for Muzafarnagar. n.a. = not applicable

a/ All respondents actually grew HYV Paddy.
Additionally, one other practice (knowledge of chemical treatment of seed) is also clearly superior as the 1978 value in Muzafarnagar was zero and had only reached 2 percent by 1982 while in Karnal the level of knowledge increased by 6 percent. For the remaining two paddy practices (5 and 6) the rate of growth in knowledge is superior in Muzafarnagar. This analysis suggests that for HYV paddy practices the growth in farmer knowledge in Karnal under the T&V system is not universally better than in Muzafarnagar. It is noteworthy, however, that of the three practices in Karnal that have superior knowledge diffusion rates two are cash demanding practices with a significant technical content. We have argued earlier that these are the practices which farmers most commonly learn directly from extension agents, and these results are consistent with that argument.

Turning to the levels of farmer knowledge about practices for HYV wheat, Table 11 shows that the estimated exponents, irrespective of the functional form, are superior in Karnal for all nine practices for which they can be estimated. The exception is the seeding rate for late sown varieties of wheat, which is known by all sampled farmers in Muzafarnagar. This is not surprising as the late sowing of wheat is much more common in Muzafarnagar than in Karnal, consequent on the prevalence of a sugarcane — wheat rotation in the former district.

These are interesting results but they are not free of caveats. First, they are based on results from sample surveys and all such surveys have a margin of error no matter how small. Second, some of the differences
Table 11: RABI 1982/83, PARAMETERS OF KNOWLEDGE DIFFUSION CURVES FOR RECOMMENDED HYV WHEAT PRACTICES AMONGST NON-CONTACT FARMERS IN KARNAL AND ALL FARMERS IN MUZAFARNAGAR

<table>
<thead>
<tr>
<th>Practice</th>
<th>Karnal District, Haryana</th>
<th>Muzafarnagar District, Uttar Pradesh</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Percentage</td>
<td>Parameter</td>
</tr>
<tr>
<td></td>
<td>Knowledgeable (N=166) a/</td>
<td>(N=92) a/</td>
</tr>
<tr>
<td>1. Varieties for Late Sowing</td>
<td>63     94     0.5500*      0.4548*</td>
<td>84     95     0.3215      0.2908</td>
</tr>
<tr>
<td>2. Seeding Rate Late Sown Varieties</td>
<td>28     47     0.2060       0.0766</td>
<td>89     100    n.a.         n.a.</td>
</tr>
<tr>
<td>3. Seeding Rate Normally Sown Varieties</td>
<td>55     87     0.4200*      0.3100*</td>
<td>28     30     0.0243      0.0070</td>
</tr>
<tr>
<td>4. Correct Spacing</td>
<td>42     71     0.3045*      0.1730*</td>
<td>77     80     0.0445      0.0349</td>
</tr>
<tr>
<td>5. Chemical Treatment Against Fungi</td>
<td>2      10     0.4200*      0.0212*</td>
<td>10     14     0.0900      0.0113</td>
</tr>
<tr>
<td>6. Chemical Treatment Against Termites</td>
<td>3      13     0.3938*      0.0272*</td>
<td>8      9      0.0320      0.0027</td>
</tr>
<tr>
<td>7. Method of Nitrogen Application</td>
<td>46     82     0.4190*      0.2746*</td>
<td>66     71     0.0580      0.0398</td>
</tr>
<tr>
<td>8. Utility of Phosphate</td>
<td>56     97     0.8087*      0.6714*</td>
<td>78     87     1.588       1.315</td>
</tr>
<tr>
<td>9. Utility of Potash</td>
<td>50     72     0.2360*      0.1449*</td>
<td>59     65     0.0637      0.0396</td>
</tr>
<tr>
<td>10. Utility of Zinc Sulphate</td>
<td>31     60     0.3010*      0.1363*</td>
<td>2      5      0.2375      0.0077</td>
</tr>
</tbody>
</table>

Note: The asterisk (*) signifies that the parameter for Karnal is higher than the corresponding value for Muzafarnagar.

n.a. = not applicable

a/ All respondents actually grew HYV wheat.
in the estimated values for $\beta$ and $\gamma$ are very small and may in fact be masked by the implicit error term. Third, even though knowledge about a practice has increased, this says nothing about the extent to which the practice is either useful or profitable to those who have learned it. Consequently, these results per se do not allow us to determine whether any gains in agricultural productivity result from the observed increases in knowledge, or whether such gains outweigh the incremental costs of T&V extension.

Nevertheless the results suggest that T&V extension in Karnal, when compared to the traditional system in Muzafarnagar has led to a noticeable increase in the rate of knowledge diffusion for almost all recommended practices for HYV wheat and several important practices for HYV paddy. Such results are consistent with the significantly higher level of extension activity prevailing in Karnal compared to Muzafarnagar. They are also consistent with other survey findings (not reported) that show (for nine of ten paddy practices and eight of ten wheat practices) the rates of knowledge diffusion amongst contact farmers to be higher than among non-contact farmers (when measured by the parameters of equation (1)). As observed in preceding sections, contact farmers have a greater degree of direct interaction with extension agents and should, ceteris paribus, have higher knowledge diffusion rates. Recall, however, that contact farmers are not necessarily representative of the farming community, and that their higher rates of knowledge may be the result of other attributes.
7. **Summary and Conclusions**

Recognizing the importance of providing any discussion of the strengths and weaknesses of the T&V system of agricultural extension, relative to other systems, with firm empirical foundations we have drawn extensively on evidence derived from recent sample surveys of farmers in India. Data from these surveys, which were undertaken in two contiguous, climatically and ethnically similar districts show that the farmers in these two areas are very similar with respect to several factors likely to influence their attitudes to innovations. One of these districts (Karnal, Haryana) is covered by the T&V system of extension whilst the other (Muzafarnagar, Uttar Pradesh) is covered by an earlier system of extension similar to that which operated in Haryana until 1979.

In Karnal we show that contact farmers, the principal target of the T&V system, are unlikely to be fully representative of their local farming community (in particular, larger farmers are more than proportionately represented), but that they may still be valuable as opinion leaders. Despite several managerial changes and extensive field staff transfers during the period of study the evidence suggests that the majority of contact farmers are visited regularly by extension agents (VEW's) and that substantial numbers of non-contact farmers are also reached directly by the VEW's. The level of extension exposure in Muzafarnagar is significantly lower. It appears that most contact farmers are aware of their role, know their VEW, and perceive the T&V system to be an improvement over its predecessor. However, non-contact farmers, and particularly smaller farmers, are much less
aware of the change in extension that has taken place in Haryana, although amongst those that are, they too perceive the change to be beneficial. There is no strong evidence that extension agents' visits are systematically biased in favor of the largest, or wealthiest contact farmers. These findings contradict claims that the T&V system, despite the increased deployment of staff and resources, is operationally ineffective and seriously biased in favor of the rich and influential.

A detailed examination of farmers knowledge of a series of recommended practices for HYV wheat and paddy showed, not only a regular pattern in the way farmers acquire information, but that the rates of knowledge diffusion in Karnal, for all wheat practices and for some paddy practices examined, are faster than the comparable rates in Muzafarnagar. These findings suggest that the T&V extension system in Karnal is more successful in delivering information to farmers than the traditional system that operates in Muzafarnagar. Although this may be viewed as an encouraging sign, it must be emphasised that the T&V system deploys more resources than the old system and hence should be more effective. Moreover, the demonstrated increases in the effectiveness of information delivery and thus farmer knowledge, although an important first step in understanding the effects of the T&V system, tell us little about the relevance of the technology being extended, its profitability at the farm level or whether any resulting gains in farm productivity are commensurate with the incremental costs. These questions remain as worthy subjects for future research.
Footnotes

1/ The ratios pertain to village level staff. The number of higher level extension staff under the T&V system is significantly higher than under the traditional system.

2/ In a district VEWs are supervised by AEOs who are, in turn responsible to sub-divisional agricultural extension officers. The latter report to the senior agricultural officer in the district, normally a Deputy Director of Agriculture. It follows that in the absence of AEO's VEW's are effectively unsupervised.

3/ The statistical test used here and in other sections of the paper is based on the large sample normality of the test statistic $Z = \frac{p_1 - p_2}{\sqrt{\gamma N_1 (1 - \gamma) [(1/N_1) + (1/N_2)]}}$ where $p_1$ is the proportion of farmers with a certain characteristic within sample i, $N_i$ are the sample sizes, and $\gamma$ is the proportion of farmers possessing the characteristic under investigation within the population.

4/ Additionally, in the survey a small number of contact farmers may have reported a single visit because they were interviewed shortly before their scheduled visit day.

5/ By that time over 95 percent of VEW's were in position.

6/ All practices examined are included in the 'packages of recommendations' that the extension systems in Karnal and Muzafarnagar are propagating.

7/ An attempt to construct a continuous time profile of knowledge diffusion was unsuccessful as many farmers were unable to recall precisely the year when they first learned of certain practices. They were, however, able to say whether they had learned more or less than four years ago.
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