

W. P. : 343

Working Paper

W.P. 343
1989
(343)



**INDIAN INSTITUTE OF MANAGEMENT
AHMEDABAD**

EXTENT OF MULTI DISCIPLINARY RESEARCH
IN AGRICULTURE

By

Gunvant A. Patel

W P No. 343
December 1980

The main objective of the working paper series of the IIMA is to help faculty members to test out their research findings at the pre-publication stage.

INDIAN INSTITUTE OF MANAGEMENT
AHMEDABAD

Extent of Multi-disciplinary Research in Agriculture

Gunvant A Patel
Indian Institute of Management, Ahmedabad

The agricultural research organizations have for long recognized the need and importance of multi-disciplinary research. The necessity of several disciplines working together was recognized by the erstwhile commodity committees for research on cotton, oil-seeds, tobacco and other crops. Their research projects provided for several scientists working together. The research institutes of the Indian Council of Agricultural Research (ICAR), the various agricultural universities and the state departments of agriculture managing research, usually provide at their research stations, multi-disciplinary team of scientists. Generally, the team consists of an agronomist, an entomologist, a plant breeder, and a plant pathologist. Depending on the complexity of the problems other disciplines are added.

The need for multi-disciplinary approach in agricultural research organizations has been stressed by research administrators. Pal¹ has stated that days are gone as far as applied research in agriculture is concerned, when a lone researcher could hope to achieve significant results. Team work is therefore considered important. Recognizing the importance of multi-disciplinary research,

¹ Organization, Management and Progress of Agricultural Research in India, Ind. Jou. Pubn. Admn, Vol. 15(3) (1969) p.376

the ICAR, has specifically introduced the system of Co-ordinated Research Projects for conducting agricultural research. According to Swaminathan², these projects are unique instruments for achieving inter-institutional and interdisciplinary integration in research. The National Commission on Agriculture³ has recognized that agricultural research is intrinsically amenable to multi-disciplinary approach. Indeed, according to the Commission, science cannot be applied to solve the problem of food, without bringing some of the disciplines together.

The organizers of agricultural research, having recognized the need of a policy for multi-disciplinary research, have been introducing structural and procedural changes for this purpose. Quantitative evaluations of this approach have not been attempted so far. It was therefore considered worthwhile to assess the extent of agricultural research involving one or more disciplines and ascertain if there is any perceptible trend of a larger share of multi-disciplinary research in the total agricultural research output.

Methodology

For the study, the following journals of agricultural research were selected: Annals of Arid Zone Research Station; Indian Journal of Agricultural Sciences; Indian Journal of Agronomy; Indian Journal of Entomology; Indian Journal of Genetics and Plant Breeding; Indian

2 Government Policy and Agricultural Research Indian Journ. Pub. Admn. Vol. 15(3) (1969) p. 563

3 Report Vol. 11 (1976) pp. 1, 7.

Journal of Horticulture; Indian Journal of Nematology; Indian Phytopathology; Journal of Indian Society of Soil Science; and Madras Agricultural Journal.

The most recent available volume of the past decade of each of the above was examined. Each article was gone through, with particular attention being paid to the tables, so as to ascertain the discipline or disciplines, which it touched. Data obtained were then compiled disciplinewise. From this table-1, indicating the percentage of articles falling in one, two or more disciplines for each of the main agricultural sciences was derived. The data for the seventies are at B in the table.

To find out if the organizational efforts for multi-disciplinary research and co-ordination had made any impact on the extent of multi-disciplinary research, the back issues of a volume, of ten years ago of each of the journal were also similarly examined. All these volumes were of the sixties, and the data are presented at A in table 1. This when compared with data of seventies (B) indicates whether there has been a growth in the multi-disciplinary research and if so, its extent.

Keeping in view the special need for multi-disciplinary approach in research on fertilizers, and hormones, articles covering these disciplines were recorded separately. It was felt necessary to have a separate view of the extent of multi-disciplinarianism prevailing amongst their research workers. In addition, the topic of fertilizer,

has also been clubbed with agronomy. The subject of horticulture, is not identified separately, but the research articles published in horticultural journals were pooled into other disciplines as for agriculture. Animal husbandary, veterinary and dairying have been excluded from the present study.

Analysis of Data

The current level of multi-disciplinary articles is 28.4 per cent. The percentage of articles falling in a single discipline, which was 77.5 per cent in the sixties got reduced to 71.6 per cent in the seventies. Thus, from the sixties, to the seventies, a perceptible increase in multi-disciplinary research is observed. Comparing the percentage of articles of more than one discipline in the sixties, with that of the seventies, the improvement is assessed at 26.2 per cent, with a corresponding reduction in the extent of mono-disciplinary research articles. The annual growth rate in multi-disciplinary research is thus 2.6 per cent.

Out of the many disciplines of agricultural research, plant physiology has shown rapid increase in the extent of multi-disciplinary research. It has now as many as 73.1 per cent of the published articles covering more than one discipline. This when compared to the sixties, indicates an improvement of over five times. More than half (51.2 per cent) of research articles on agronomy (including fertilizers, bio-fertilizers) are now multi-disciplinary. The improvement recorded over sixties is, however, only 10.8 per cent. In both these disciplines there is also some improvement in the extent of research articles covering more than two disciplines.

There has been a rapid improvement of 49.5 per cent in the extent of multi-disciplinary research in plant breeding. The extent of multi-disciplinary research in this science is now 48 per cent. Research on plant breeding has contributed greatly towards increased agricultural production. The problems now being faced, such as adaptability of varieties to the varied agro-climatic conditions, competitiveness of varieties, and the continued high amplitude of agricultural output as a result of climatological influences, indicate the increased need of multi-disciplinary research in plant breeding.

Study of soil and related disciplines in increasing production is beginning to attract greater attention, but only 32 per cent of the articles on soil are multi-disciplinary. Soil scientist need to pay greater attention to development of multi-disciplinary research, so that the complex problems of agricultural production can be tackled satisfactorily. The recorded increase of 44.1 per cent over the decade in the extent of multi-disciplinary research in soils however augurs well for the future.

The sciences of plant pathology, entomology, and nematology do not seem to have developed extensive multi-disciplinary research. Only, 21.8, 17.0 and 14.5 per cent of the articles are respectively multi-disciplinary. The large number of total articles in plant pathology and entomology are to be noted. The numerous pest and disease problems, thrown up in the wake of green revolution are well known. But unless these sciences strengthen their ties with

plant breeding, soils and other disciplines, in a multi-disciplinary approach, the constraints in agricultural production will not get detected and removed. In comparison with the applied agricultural sciences, genetics which is a fundamental science, has significantly less proportion of multi-disciplinary research articles. This finding lends support to the reliability of the methodology adopted in determining the extent of multi-disciplinary research.

Linkages of disciplines

For each discipline in addition to the number of articles of one or more disciplines, the discipline(s) to which they were associated were also noted. From this data, the existing links of different disciplines become known. The figure gives this information for some disciplines.

Plant physiology research has associated itself with several other disciplines. These are nutrition, seed technology, climatology, and irrigation research. As the number of articles falling in individual disciplines, is not large, a quantitative comparison can not be completely accurate. However, linkages of plant physiology with nutrition (23.2 per cent of total articles) and seed technology (19.2 per cent) are stronger than with the remaining disciplines (4 to 8 per cent).

The subject of agronomy (including fertilizer and bio-fertilizers), has numerous associations. As many as nine linkages were observed. Its strongest associations were with plant breeding (12.6 per cent of articles) and nutrition (10.3 per cent). The other disciplines with

which the agronomists collaborate were study of hormones, soils, agriculture, economics, plant physiology, plant pathology, climatology and entomology. The extent of its important associations with two disciplines were with plant breeding--nutrition, plant breeding -- plant pathology, plant breeding -- agricultural economics, plant breeding -- irrigation, soils-irrigation and plant physiology-- agricultural economics.

The links of various other disciplines are given below:

- | | |
|-----------------|--|
| Irrigation | .. Agronomy (including fertilizers 25 per cent), Agricultural economics, climatology, and plant physiology. |
| Plant breeding | .. Genetics (42 per cent), seed technology, and climatology. |
| Soils | .. Entomology (16.6 per cent), agronomy, geology, bacteriology; irrigation -- plant breeding, land-planning; agronomy--plant breeding. |
| Plant pathology | .. Plant breeding (7.1 per cent), plant physiology (3.4 per cent), ecology, entomology, climatology, nutrition, agronomy, bacteriology, nematology, soils, agricultural economics. |
| Entomology | .. Agronomy (6.5 per cent), plant breeding (4.1 per cent), nutrition, ecology, agricultural economics, plant physiology, and soils; agronomy--plant breeding. |

- Nematology .. Plant physiology (5.4 per cent), agronomy, bacteriology, plant breeding, plant pathology and soils.
- Genetics .. Plant breeding, nutrition, ecology, plant physiology.

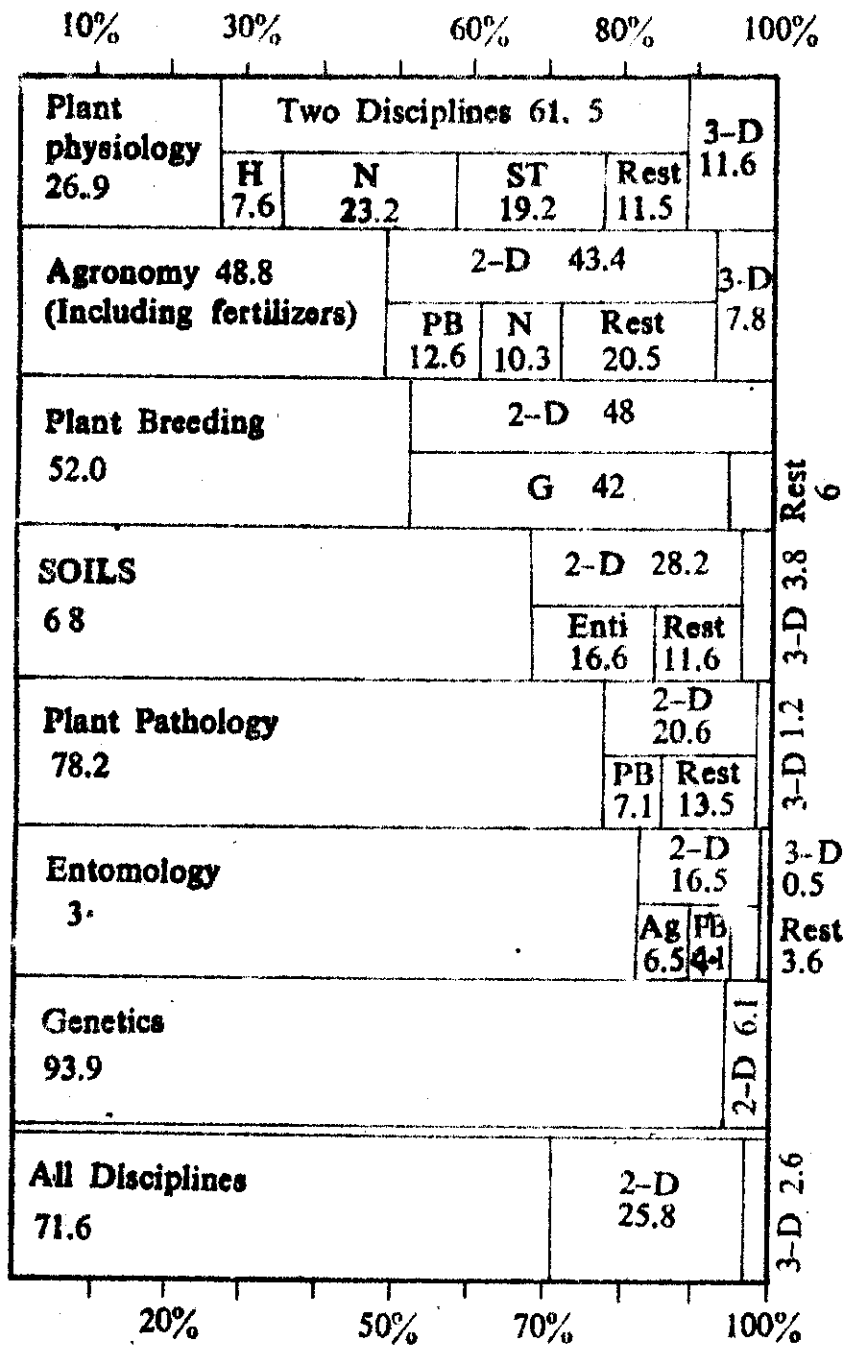
SUMMARY

The extent of multi-disciplinary research in agriculture, is measured by noting the percentage of research articles covering one or more disciplines, in ten journals of agricultural research. Currently, 28.4 per cent of the articles appearing in these journals are observed to be multi-disciplinary. The growth in multi-disciplinary research is estimated at 2.6 per cent per annum. The extent of multi-disciplinary research is the highest in plant physiology (73.1 per cent), followed by agronomy including fertilizers (51.2 per cent). The order of decreasing extent of multi-disciplinary research of the other sciences is plant breeding, soils, plant pathology and entomology. In comparison with the applied agricultural sciences, the extent of multi-disciplinary research is much less in the fundamental science of genetics.

Table 1: Number and Percentages of Articles in Various Disciplines
of Agricultural Research in the Sixties (A) and Seventies(B)
(Percentages in bracket)

		Total	1 Dis- cipline	2 Dis- cipline	3 Dis- cipline	4 Dis- cipline
Plant Physiology	A	15	13 (86.7)	2 (13.3)	-	-
	B	26	7 (26.9)	16 (61.5)	3 (11.6)	-
Agronomy	A	43	25 (58.1)	13 (30.2)	5 (11.6)	-
	B	68	17 (25.0)	36 (52.9)	13 (19.2)	2 (2.9)
Fertilizers	A	48	21 (43.8)	24 (50.0)	2 (4.2)	1 (2.0)
	B	77	39 (50.6)	31 (40.3)	7 (9.1)	-
Agronomy Fertilizers Bio-Fertilizers†	A	91	49 (53.8)	39 (42.9)	3 (3.3)	-
	B	166	81 (48.8)	72 (43.4)	13 (7.8)	-
Irrigation	A	5	4 (80.0)	-	1 (20.0)	-
	B	20	12 (60.0)	8 (40.0)	-	-
Plant breeding	A	53	36 (67.9)	15 (28.3)	2 (3.8)	-
	B	50	26 (52.0)	24 (48.0)	-	-
Soils	A	63	49 (77.8)	11 (17.5)	3 (4.7)	-
	B	78	53 (68.0)	22 (28.2)	3 (3.8)	-
Bio-fertilizers	A	-	-	-	-	-
	B	21	15 (71.4)	4 (19.1)	2 (9.5)	-
Hormones	A	21	17 (81.0)	4 (19.0)	-	-
	B	36	27 (75.0)	9 (25.0)	-	-
Plant Pathology	A	111	93 (83.8)	18 (16.2)	-	-
	B	238	186 (78.2)	49 (20.6)	3 (1.2)	-
Entomology	A	69	61 (88.4)	8 (11.6)	-	-
	B	182	151 (83.0)	30 (16.5)	1 (0.5)	-
Nematology	A	6	4 (66.7)	2 (33.3)	-	-
	B	55	47 (85.5)	8 (14.5)	-	-
Genetics	A	24	23 (95.8)	-	1 (4.2)	-
	B	66	62 (93.9)	4 (6.1)	-	-
Rest	A	27	27 (100.0)	-	-	-
	B	17	17 (100.0)	-	-	-
All Disciplines	A	485	376 (77.5)	99 (20.4)	10 (2.1)	-
	B	955	684 (71.6)	246 (25.8)	25 (2.6)	-

**Figure - Percentage of Mono and Multidisciplinary
Articles of Various Agricultural Sciences
in the Seventies**



AG Agronomy; D Disciplines;
 ENT Entomology; G Genetics;
 H Hormones; N Nutrition;
 PB Plant Breeding; ST Seed Technology.