

A NOTE ON THE STUDY OF THE EXPERIMENTAL ERRORS IN GROUPS OF AGRICULTURAL FIELD EXPERIMENTS CONDUCTED IN DIFFERENT YEARS

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Introduction

Agricultural field experiments are generally conducted on different crops at a few selected Centres/Stations. These stations are, in general, selected so as to represent different tracts representing different soil types and agro-climatic conditions. As such, the results obtained at the Agricultural Research Stations can be assumed to be applicable to the tracts they represent. However, the results of a single experiment conducted in any particular year can not be relied upon, as they are subject to the climatic conditions which fluctuate from year to year at any place. Hence to draw any conclusions which are reliable and applicable to at least a few years to come, it is necessary to repeat the experiment for a number of years with the same set of treatments adopting the same cultural and other agronomic practices. The treatment effects averaged over the years will give more stable information.

The Statistical problems involved in combining the results of similar experiments repeated at different places in a year or during different years at the same place have been discussed at length by Cochran And Cox [1], Kemthorne [2] etc. with certain basic assumptions.

In the simple case of experiments laid out in Randomised Blocks with uniform number of replications, error variances may be homogeneous or heterogeneous. Heterogeneity of error variances makes the pooled analysis difficult. However, presence of 'treatments X years' interaction, which may be verified by weighted analysis, will solve the problem of testing the over-all treatment effects.

It is of common experience that the environmental conditions of different places are altogether different. It may, therefore, be expected that the experimental errors may prove to be heterogeneous. However, in the case of any particular place the environmental conditions do not vary much from year to year and hence we may not expect heterogeneity of error variances.

Efforts have been made in this paper to study the behaviour of experimental errors and presence of 'treatments X years' interactions in the case of groups of experiments, involving single experimental error, conducted at different research stations in the State of Gujarat during different years of the period 1960-65. Homogeneity or otherwise of experimental errors has been studied with reference to different crops, types of experiments (viz. Manurial, cultural irrigational etc.) and broad soil types.

Similar study on groups of experiments laid out in designs, where two or more experimental errors are involved, will be made separately.

Materials and methods

Results of 199 groups of experiments comprising 584 individual experiments conducted at different agricultural research stations in the state of Gujarat, on different crops have been considered in this paper to study the behaviour of experimental errors. The data were collected from the compendium of National Index of Agricultural Field Experiments [3]. However all these groups of experiments are of the type conducted at the same place over different years. These experiments are laid out in designs involving single errors. The crop wise distribution of 199 groups containing 584 experiments according to homogeneity or heterogeneity of errors and (treatments X years) interaction being present or absent for different crops has been done. Similar distributions for different type of experiments, viz, manurial (M), cultural (C), manurial cum cultural (MC), irrigational (I), control of pests and diseases (D) and mixed cropping (X) and for different soil types, viz. Sandy, Sandy loam, Clay loam, Clay and deep black cotton soils have been done:

Discussion

On an average almost 50% of the groups of experiments revealed heterogeneity in their error variances. However some of the crops have maintained to a greater percentage the homogeneity of their errors. [eg. Sugarcane (77.8%), Bajra (64.0%), Cotton (60.0%), Paddy (52.4%) and Wheat (52.2%)]. Crops like jowar and gram,

and mixed crop experiments have shown variability in experimental errors in as many as over 90% of the cases.

Experiments with insecticidal and pesticidal treatments have indicated homogeneity in a greater percentage (about 70%) of cases, while types like M, C and I have indicated, homogeneity in a little over 50% of the cases. MC and X, type of experiments showed heterogeneity in their error variances to a greater extent i.e. about 64% and 87% respectively.

It is interesting to observe that different types of soils though varying very much in their structure and texture, have shown, to almost equal degree, homogeneity in about 50% of the cases excepting in the case of deep black soils.

The interaction of treatments X year is present in about 35.7% of the cases irrespective of the fact whether experimental error variances are homogeneous or heterogeneous. Crops like wheat, bajra and jowar and experiments with crop mixtures have shown greater percentage than the others.

Among the types of experiments, (MC) type and mixed cropping (X) showed the presence of treatments X years interaction in about 50% and 75% of the respective cases. While irrigational type of treatments have shown interaction with years in as few as 18.8% of the cases.

Sandy and sandy loam type of soils indicated in nearly 50% of the cases, the presence of treatments X years interaction, while in the case of deep black soils the percentage is as low as 21.4%.

It is observed that in about 66.3% of the total number of groups, the results over years could be combined and treatments could be tested either by pooled error or by the (treatments X years) interaction. However in the case of gram the percentage of such groups is very low. i.e. 20%.

Different types of experiments like M, C, MC and I have indicated to more or less the same degree, the combining capacity of individual results into groups i.e., 63 to 69%.

It is interesting to note that the experiments conducted in sandy and sandy loam type of soils could be combined to the extent of over 80% of the cases while, those conducted in deep black soils could be combined only to the extent of 50% of the cases.

The number of groups of experiments have been split into different categories according to No. of experiments per group viz.,

A-2 experiments per group, B-3 experiments per group and C-more than 3 experiments per group (each experiment of a group was conducted in different year at the same place), and according to homogeneity and heterogeneity of error variances and is discussed below for crop-wise, type-wise and soil type-wise, and also overall crops or types of experiments or soil-types.

Crop-wise

For crops, paddy, wheat, bajra and cotton the No. of groups were 21, 46, 25 and 40 respectively. The No. of groups for other crops was less than 20 in each case. The percentage of groups with homogeneous error variances was found maximum in category-A and minimum in category-C in case of Paddy, Bajra and Cotton. Obviously the trend in these cases was reverse in case of heterogeneity of error variances. In other words there is progressive decrease of percentage of No. of groups having homogeneity of error variances from category A to C.

Type-wise

The No. of groups of experiments under the types of Manurial (M), Cultural (C) and Manurial-cum-cultural (MC) were 96, 30 and 39 respectively. In other types the No. of groups was less than 20 in each case. In case of types C,M and MC no consistent trend has been observed.

Soil-type

The No. of groups under sandy loam and clay loam soils were 36 and 118 respectively. For other types of soils the No. of groups was less than 20 in each case. For sandy loam and clay loam soils the similar trend as found in the case of crops like paddy, bajra and cotton has been observed.

Considering the groups over all the crops or type of experiments or soil types the percentage of groups with homogeneity of error variances was more in case of category-A. This percentage decreased progressively for the categories B and C, where experiment was conducted for 3 years and more than 3 years.

REFERENCES

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