ANALYSING THE YIELD PERFORMANCE OF SOME COWPEA BREEDING LINES EVALUATED FOR RESISTANCE TO MARUCA POD BORERS IN NIGERIA

AGWUEGBO. S.O.N. [1] AND. ADEGBITE A.E [2].
[1]Department of Mathematical Science, University of Agriculture,
[2]Department of Biological Science, University of Agriculture, Abeokuta

ABSTRACT

This study strived to analyse the performance of some cowpea varieties, which combine resistance to Maruca pod borers with good yield. These varieties have shown some levels of resistance to Maruca pod borers without insecticide protection in Nigeria. However, their performance differs among locations consequent upon differential insect pressure. The method of analysis embraced two factor factorial experiments, the two factors being locations and insect pressure as reflected in the yield of the cowpea lines. Each of the factors has two levels which are spray and no spray and the factors were considered simultaneously. The analysis was based on testing whether there is a significant effect due to either factor, and if any effect of the first factor is dependent on the second (the interaction). The result of the analysis indicated that differences between location and insect pressure significantly affected the performance of the cowpea varieties. The location insect pressure interaction is insignificant at 5% level. The analysis of various models confirm that effects of the different factors (rows, columns, or treatments) are additive and that the residual errors are normally and independently distributed with the same variance.

Keywords: Resistance, Maruca pod borers, Insect pressure, location.

TRODUCTION

The indigenous cowpea varieties are characterized by prostrate growth habit, indeterminate, late flowering, maturity and low yield. However, research efforts by scientists at IITA have produced breeding lines and roved varieties of cowpea that do not express the deficiencies known for the indigenous cowpea varieties.

Production constraints of cowpea include diseases and insect pests attack, poor plant type, drought, essive moisture and temperature extremes. The choice of varieties suited for specific location is therefore ry important factor in cowpea production.

This study is not actually a direct comparison of varieties which are certainly known to be different, but xamine whether the insect pressure and its effect on yield is different for different locations. Subject to any rnal constraints, the factors under investigation should represent those variables likely to have an important ct on the yield performance. It is interesting to note that under suitable conditions the effect of the factors he response can be determined by analyzing the variability of observations.

THODOLOGY

d Design and Specific Details

Evaluations were carried out on some cowpea varieties obtained from IITA, Nigeria for resistance to pea diseases and insects pests. The evaluations were conducted at two locations in Nigeria. The locations Ibadan (Oyo State), a sub-humid region and Mokwa (Niger State), in the Savanna region.

Each of the 35 entries were planted in a plot of four rows of 5m length with inter-row spacing of 75cm. r seeds were planted per hole at a spacing of 20 cm but later thinned to two plants per hill. The plots were pletely randomized and four replications were planted for the protected and the unprotected plots. Karate sprayed on the protected plots at a concentration of 5% from the time of bud initiation to pod maturity. The middle rows were evaluated and harvested for yield performance which is known to be affected by insect sure and location differences. The yield data obtained are shown in Table 1.

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It is necessary to postulate a model that links the observations with the combinations of factor setting ed factor levels. To eliminate unforeseen bias, 140 experimental units were assigned using randomized

blocks design. The randomized block design involves the grouping of "similar" test units into blocks random assignment of treatments to test units in each block. Similarity is determined by matching those u the expected extraneous source of variation.

The insect pressure which differed in the total grain yield (kg/ha) with locations were being ente in full. By calling the insect pressure A and the locations B, we considered 2 x 2 factorial experimen model that underlies the design is given by

$$Y_{ijk} = \mu + \alpha_i + \beta_j + (\alpha\beta)_{ij} + e_{ijk} \qquad \begin{matrix} i = 1, 2, - - - \ a \\ j = 1, 2, - - - \ b \\ k = 1, 2, - - - c \end{matrix} \qquad (1)$$

The model suggests that any response Yijk can be written as the sum of five additive factors, μ overall mean effect. αi the ith differential or main effect of factor A which is the insect pressure effect the performance of cowpea. βj the jth differential or main effect of factor B which is the location effect the performance of cowpea. (αβ)ij called the interaction effect at the ith level of factor A, and the jth, le of factor B, and eijk an independent N(O, σ2) random variable. It is assumed that the distribution of the variable in each of the population is normal and that the population has the same variance.

There are three main hypotheses, deduced from the model. The hypotheses can be written as:

$Ho^{(1)}$: $\alpha_i = 0$ $\quad i = 1, 2, —\ a$

$Ha^{(1)}$: not all α_i are zero

$Ho^{(2)}$: $\beta_j = 0$ $\quad J = 1, 2, —\ b$

$Ha^{(2)}$: not all β_j are zero

$Ho^{(3)}$: $(\alpha\beta)_{ij} = 0$ $\quad i = 1, 2, — a, \ \ j = 1, 2, — b$ (2)

$Ha^{(3)}$: not all $(\alpha\beta)_{ij}$ are zero.

The first two hypotheses state that there are no differences respectively due to the levels of the A B factors, while the third says that the effects due to factors A and B are additive. These hypotheses tested based on observed values of random variables having F probability distributions. The ANOVA tab given in Table 3

In Table 3, the entries in the "sum of squares" and "degrees of freedom", columns are derived from the algeb identities.

$$\text{"}(Y_{ijk} - Y...)^2 = bc \ \text{"}(Y_{i..} - Y...)^2 + ac \ \text{"}(Y_{.j.} - Y...)^2 + C \bullet (Y_{ij.} - Y_{i..} - Y_{.j.} + Y...)^2 + \text{"}(Y_{ijk} - Y_{ij.})^2 \qquad (3)$$

and the degree of freedom is

$$abc - 1 = (a - 1) + (b - 1) + (a - 1)(b - 1) + ab\,(c - 1) \qquad (4)$$

RESULTS AND DISCUSSION

Table 1 contains performance of some cowpea lines evaluated for resistance to Maruca Pod Bore two locations during 2001 planting season. The factors were insect pressure (A), with levels

- spray and
- no spray

and location (B) at

- Ibadan and
- Mokwa

1: Yield Performance of some Cowpea Breeding Lines Evaluated for Resistance to Maruca Pod Borers in two locations during 2001 Planting Season.

ety	Total Grain Yield (kg/ha) MOKWA		Total Grain Yield (kg/ha) IBADAN	
	No Spray	Spray	No Spray	Spray
TVu 13672	688	655	439	730
TVu 13677	618	638	515	729
TVu 13684	520	711	415	597
TVu 14010	619	772	873	885
TVu 14175	303	945	722	1003
TVu 14195	469	739	644	881
TVu 15615	725	803	689	944
TVu 15639	471	721	866	1080
TVu 15658	533	793	980	1119
TVu 15670	348	811	873	1153
TVu 15682 TVu	586	648	519	866
15722	604	681	575	753
TVu 15725TVu	670	907	733	871
15740 TVu	464	796	724	922
15741 TVu	470	778	680	821
15750 TVu	583	859	558	740
15764 TVu	459	905	736	971
15777 TVu	515	716	382	607
15797 TVu	520	974	847	1186
15813 TVu	526	733	775	1013
15825 TVu	440	1114	996	1185
15839 TVu	348	904	801	642
15851	571	755	418	1030
TVu 16444	703	923	774	1424
TVu 16464	548	1044	886	778
TVu 16489	565	646	501	983
TVu 16495	635	793	734	1051
TVu 16505	536	753	821	1111
TVu 16722	300	762	804	912
TVu 16725	82	964	701	898
TVu 14476	400	729	579	1001
TVu 16648	400	708	949	1012
TVu 16646	403	841	387	703
TVu 15687	292	892	562	768
TVu 16467	540	750	609	

To proceed with an analysis we assumed that treatments were applied between the location and in pressure and that the assignment of the treatment combinations to the 140 cowpea varieties can be regarde fixed, subject only to there being 35 varieties of cowpea for each combination. Marginal totals of the da Table 1 are in Table 2, and an analysis of variance for a 2 x 2 factorial experiment of location and insect pres effects on cowpea in Table 3.

Table 2: Combined yield performance of the cowpea breeding lines evaluated.

Insect Pressure	Ibadan	Mokwa	Total	Mean
Spray	322445	28163	60408	862.97
No Spray	24067	17456	41523	593.19
Total	56312	45619	101931	
Mean	804.446	651.7		728.08

Table 3: Analysis of variance table for 2 x 2 factorial experiment of insect pressure and location effects on the cowpea lines studied.

Sources of Variation	Sum of Square	d.f.	mean square error	F. ratio
Insect pressure (A)	2,546,343.69	1	2,547,343.69	55.28*
Location (B)	816,746.62	1	816,746.62	17.8*
Insect Pressure location (AB)	45,877.04	1	45,877.04	1.91
Residual	3,259,534.79	1	3623,967.17	
Total	6,669,502.14	139		

The calculated ratio for insect pressure - location effect (interaction effect) does not significantly affe the performance level at 5 percent level since $F_{0.05,\ 1,\ 136} = 3.84$. The evidence of no significance indicat that the effects are additive. This shows that the effectiveness of the insect pressure is not dependent on t location and vice versa.

In considering the effectiveness of insect pressure and location effect, the calculated ratios are significa at 5 percent level. Suppose the interaction term had tested significant, we would not have bothered to check f the significance of the insect pressure effect and the location effect by themselves, rather we would ha looked for the best combination of an insect pressure within a location effect, because a significant interacti term would have indicated that the effects were not additive which will imply that the insect pressure effec were different for some levels of location and vice versa.

To test the performance of some cowpea varieties evaluated for resistance to insect pest pressure i Ibadan and Mokwa, we assume that there is an underlying pattern known as the model, and that the observatio differ from this pattern because of super imposed random errors. In this case the random errors are th variations, which individual cowpea varieties would have shown if they had been grown under identical condition To carry out a test of significance we made three assumptions viz:

(i) That the random errors for the 35 varieties are independent of one another. This really assumes that th experiment has been carried out with proper care.

(ii) That the random error have normal distribution, and

(iii) that the true "within cell" variance is the same for all cells.

The calculated variances will of course not be equal, but if there are several observations per cell, on may be able to test whether they differ significantly. After assumption one, assumption three is the mos important. It is more important than the normality assumption two, since it has been shown that ANOVA test

fairly "robust" to departures from normality. Of course if these assumptions are grossly astray from the real iation then any conclusions from a significance test may be quite wrong (1, 2). (Churchhill, 1976., Chatfield, 80).

ANOVA should be recognized as an aid to the interpretation of experimental and sometimes observational ta, and should not be treated as a simple mechanical process with data being poured in and the one and only ht answer being pumped out (Please, 1987).

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