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VARIATION OF RICE YIELD WITH TEMPERATURE AND RAINFALL AT OGOJA, NIGERIA

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ABSTRACT

The efficacy of the powder of a natural plant product (Acorus calamus L.) and two synthetic insecticides (i.e. Pirimiphos methyl and Rotenone) was compared in the laboratory for the control of Sitophilus oryzea (L), Rhizopertha dominica (F) and Tribolium castaneum (Herbst) in stored wheat grains. Seven concentrations of the test chemicals (i.e. 1.25, 2.5, 5.0, 10.0, 15.0, 20.0 and 25g per kilogramme of wheat grains) were used. The control treatment consisted of 1kg untreated wheat grains. Percentage mortality was recorded cumulatively at 48h intervals for 16 days. Pirimiphos-methyl at 5g/kg of wheat grains gave 100% mortality of S. oryzea as against A. calamus powder and Rotenone that gave 46.56% and 26.44%, respectively. Mortality observed on R. dominica indicated that 25g of A. calamus powder resulted in significantly (P 0.05) higher percentage mortality 83.22% than pirimiphos-methyl that gave 56.65% and Rotenone with 36.47%. Only pirimiphos-methyl and Rotenone was toxic to T. castaneum, A. calamus powder was not.

KEY WORDS: Natural chemicals, synthetic insecticides, wheat grains, cereals.

INTRODUCTION

Agriculture, apart from being an important mode of production, represents a life style in the African economics. In Nigeria today, over 70% of the population are involved in agriculture, either directly, as farmers, or indirectly in food processing, marketing and servicing industries. Globally, agriculture remains a major and the most extensive industry, not only throughout the less developed world but also in heavily urbanized areas (Mornu, 1985). It is in respect of this fact that large sums of money are being budgeted by various levels of government annually for the development of agriculture for the provision of food for its citizens.

However, despite impressive advance in agricultural technology, Nigeria still faces acute shortages in food as a result of its low agricultural productivity. Moreso, there has been the issue of yield fluctuation in recent years, thus making the availability of food for human consumption an unpredictable phenomenon. Output or yield capacity varied seasonally or yearly and this is reflected in the quantity of food available for consumption by Nigerians (Idachaba, 1991).

In any case, this irregularity in food crop yield and supplies is the consequence of a variety of social and economic factors, in addition to the obvious limitations imposed by adverse geographic and climatic conditions. The weather and climatic factors that have to do with agricultural productivity and development include: solar radiation, humidity, sunshine, rainfall, evapotranspiration and temperature. Basically, Nigeria is yet to be developed scientifically so as to be able to arrest these imprints which climatic variables like temperature and rainfall have on agriculture. The result and effect of this unfortunate scenario has been persistent food shortages, malnutrition and death of a great majority of the people in the country.

As a matter of fact, in three decades past, the main stable foodstuff in Nigeria have been Cassava, Sorghum and Yam. The cultivation of rice in appreciable scale and dimension commenced in Nigeria only during the Second World War when there was a halt in the importation from the far East (Ojo, 1991). Rice stand in the Nigerian's dietary system changed tremendously about a decade ago with rice gradually assuming a staple status. This is reflected in the estimasted high rate of its production (Olayide, 1986).

Unfortunately, it has been realized that this increase in the demand of rice in recent time has not been accompanied with a corresponding increase in production. Rather an astronomical increase in importation has been witnessed with its concommittant effect on the Nations foreign exchange reserve. This variation in the productive capacity or yield of rice is stimulated principally by the interaction of climatic elements. This invariably calls for an understanding of the workability of the climatic elements in rice production so as to guarantee efficiency in productivity.

AIMS AND OBJECTIVES

The aims and objectives of this study include:

a: To determine the nature of the relationship between agro-meteorological variables and rice production at different stages of growth and development.

b: Evaluation of the variation in the yield of rice in the area for the period under study.

METHODOLOGY

Information on the varieties of rice as well as yield in tons was collected from the Cross River Basin and Rural Development Authority and the Cross River Agricultural Development Project, Ogoja. This is because experience has shown that information on output and yield provided by farmers who keep no records are notoriously inaccurate, especially when given in European units of measure with which they are usually unfamiliar.

In the study area, rice is planted in May and harvested in August. The sample sizes for this study were two plots of rice, each from the agricultural agencies chosen for the study. The sample plots were measured in hectares of various sizes as indicated in table 1 below and they vary from year to year.

Data on agrometeorological variables (temperature and rainfall) for the specified length of time as indicated in this study were collected from the agrometerological station, Ogoja. Also, oral interviews as well as personal observations were made in this study.

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The multiple correlation analysis was employed to determine the relationship between agrometeorological variables and rice yield. Test of significance was carried out to determine whether the relationships are significant.

To analyze the output trend in the yield of rice for the period under study, the mean, standard deviation, and coefficient of variation and percentage deviations from the mean were employed. The mean () and the coefficient of variation (c.v) were used to determine the critical limits of the yield during the period of study.

This was to help determine years of excess of deficit in yield capacity. The limits were defined by (+ c.v) for the upper limits and (- c. v) for the lower limits. Positive value beyond the limits were considered as excess while negative values beyond the limits was considered deficit.

The multiple correlation analysis was employed to determine the relationship between agrometeorological variables and rice yield. Tests of significance were carried out to determine whether the relationship is significant.

DISCUSSION OF FINDINGS

DATA ON RICE YIELD AND AGROMETEROLOGICAL VARIABLES

Table one below shows information on the yield of rice as well as data on Rainfall and temperature as collected from the Cross River Basin and Rural Development Authority and the Agricultural Development Project. This forms the basis for the analysis of the variations in rice yield as well as the relationship between rice yield and temperature and rainfall in the study area as seen here under.

Also, the rainfall and temperature trend for the study period is indicated in Tables one and two (1 & 2) below.

CORRELATION OF RICE YIELD WITH AGROMETEOLOGIC VARIABLES DURING GRAINFILLING PHASE

TABLE 1:

DATA ON RICE YIELD, AGROMETEOROLOGICAL VARIABLE AND FARM SIZES IN OGOJA

YEARS (Y)	RICE YIELD (TONS)	MEAN AND RAINFALL (CM)	MEAN TEMEPRATURE (OF)	FARM SIZES (HECTARES)
1991	20	6	3	6
1992	18	7	4	6
1993	23	7	4	8
1994	19	7	2	4
1995	20	7	5	5
1996	22	7	3	5
1997	17	6	3	3
1998	16	7	5	3
1999	23	7	3	7
2000	21	6	4	7
2001	24	7	4	8

SOURCE: CRBRDA AND ADP

TABLE 2:

SUMMARY TABLE OF CORRELATION OF RICE YIELD WITH AGROMETIC VARIABLES DURING THE NURSERY PHASE

CORRELATION VARIABLES	TEMPERATURE	RAINFALL
Correlation coefficient	0.25	-0.45
Level of significance	0.05%	0.05%
Coefficient of determination	0.6	0.18
Degree of freedom	N - 2 =	11 - 2 =9

TABLE 3:

SUMMARY OF CORRELATION OF RICE YIELDWITH AGROMETELOGIC VARIABLES DURING GAINFILLING PHASE

CORRELATION VARIABLES	TEMPERATURE	RAINFALL
Correlation coefficient	-0.24	0.31
Level of significance	0.05%	0.05%
Coefficient of determination	0.5	0.09
Degree of freedom	N - 2 =	11 - 2 =9

CORRELATION OF RICE YIELD WITH AGROMETEOROLOGICAL VARIABLES

TABLE 4:

SUMMARY OF CORRELATION OF RICE YIELD WITH AGGROMETEROLOGICAL VARIABLES DURING THE RIPPENING PHASE.

CORRELATION VARIABLES	TEMPERATURE	RAINFALL
Correlation coefficient	-0.24	0.06
Level of significance	0.05%	0.05%
Coefficient of determination	0.16	0.36
Degree of freedom	N - 2 =	11 - 2 =9

RELATIONSHIP BETWEEN RICE YIELD AND PRE-SOWING RAINFALL

The importance of pre-sowing rainfall in the overall development and growth of crops cannot be over emphasized. The entire life span of crops hinges remarkably on the amount of moisture available on the ground before sowing is done. This issue has been stressed by Olaniran, (1982). Thus, it is this relative importance of pre-sowing rainfall that has necessitated its consideration in this study.

In this study, it was discovered that pre-sowing rainfall with rice has a positive correlation of 0.08. This goes further to show that even though it has the implication that as the pre-sowing rainfall increases the yield of rice increases; the relationship is a weak one. This is inferred from the coefficient of determination, which explained only 1% of the variation in rice yield being caused by pre-sowing rainfall. When this result was tested for significance, it was found not to be significant at 0.05% level. This has the implication that pre-sowing rainfall is not significantly related to the yield of rice in this study. In sum, it could be seen then that the coefficient obtained may have occurred by chance.

CORRELATION OF RICE YIELD WITH AGROMETIC VARIABLES DURING THE NURSERY PHASE

From the above table, it could be seen that temperature during the nursery phase has a positive correlation with the yield of rice (0.25). this implies that as temperature during the nursery phase increases, there is the likelihood for an increase in the yield of rice. In this phase, it is the only variable with positive correlation. A test of significance at 5% level reveals that this is not significant despite the fact that it is the only variable with a positive correlation. This has the indication therefore that this positive correlation occurred by chance.

The non-significant is backed up by the coefficient of determination (r^2), which explained only 6% of the variations in the yield. The remaining 94% is unexplained and may be attributed to other factors that come into play for the growth of rice such as soil, topography, humidity and evaporation.

Observations from the table 1 above also indicated that rainfall was negatively correlated with rice yield. The correlation coefficient is 0.05 implying that as amount of

rainfall during the nursery phase increases, the yield of rice decreases. The significance test carried out at 5% level on this testified that the coefficient in not significant. These in all ramifications have the implication that it must have occurred by chance. The matter of negative correlation may not be of much concern in as much as the likelihood of chance factor is still inherent in it. The co-efficient of determination (r^2) showed that this variable (rainfall) accounted for only 18% of the variation in the yield at this phase. The remaining 82% that is unexplained may be accounted for by other agrometerological variables not carried out in this study.

The strength of the linear association of the rate of temperature with rice during the grainfilling phase of the crop was also studied. The correlation coefficient of 0.24 as seen in the table 2 above indicated that this was negatively correlated. This has the implication that an increase in the rate of air temperature was associated with decrease in the value of yields. The coefficient of determination (r^2) showed that temperature accounted for virtually 5% of the variation in the yield. The significant test conducted at 5% leveled that this was insignificant.

On the other hand, rainfall has a positive correlation with rice yield in this phase. The correlation coefficient was 0.31. In other words, as the amount of rainfall increase, the yield of rice increases too during this phase. This coefficient, was a as a matter of fact, tested at 5% matter of fact, tested at 5% level of significance, but this proved to be insignificant.

The coefficient of determination sowed that this only explained 9% of the variation in yield.

The temperature rate during the ripening phase has been found to correlate negatively with yield (-02). The negative correlation has the implication that increase in the rate temperature during this phase was associated with reduction in yield. The significance test carried out indicated that the coefficient is insignificant. Hence, the correlation is said to have occurred by chance

Rainfall during the ripening phase seems to be positively correlated with yield (0.06) implying that an increase in rainfall is followed by a increase in yield. Inspite of it's positive correlation, the coefficient of determination (r^2) indicated that rainfall explained only 36% of the variations in yield thereby indicating that this association might have occurred by chance. Thus, it could be categorically stated not much confidence could be reposed on the coefficient.

VARIATIONS IN THE YIELD OF RICE (1991 2001)

The chart below gave descriptions of the variations in the yield of rice during the study period (1991-2001). The chart showed the percentage departures of the yield from normal for eleven years for which data was available. The analysis gave the mean, standard deviation and the coefficient of variation (c.v) of the yield of rice. This is consequents upon the fact that variation exists in yield from one year to another.

One important feature of the chart is that it tries to show the boundaries or critical limits which determines the surplus or deficit of the yield. A case is considered surplus when its exceeds the critical limits which is delimited by (+ c.v) and a deficit when it falls below the critical limit which is also delimted by (- c.v). The values that fall within the critical limits are considered as being normal for those years.

Table one (1) shows the percentage department of yield of rice from mean ((). The figure showed that in 1991, the yield of rice rose above normal for the period of study. The value reached was 34%. But in 1992, the yield fell below normal, with a value of 11%. The yield rose again in 1993 above normal reaching the value of 21%. The succeeding two years experienced a fall below normal with 21% and 34% respectively. This was followed by a rise again to the tone of 34% in 1996. the following year 1997 witnessed a fall below normal 53% Following that was a rise above percentage normal between 1998 and 2001 with values of 22%, 21%, 50% and 11%.

Rice yield during this period of study had 20, 2.5 and 30% as the mean, standard deviation and coefficient of variation respectively. Thus, the coefficient of variation indicated that there was no high variability of rice yield during the period under study in Ogoja. Thus, there was a steady supply of rice for consumer in the area during the study period.

CONCLUSIONS

This study was geared towards assessing the variations in the yield of rice as influenced by agrometeorological variable such as rainfall and temperature. This assessment was centered critically on the different stages in the growth of rice. The findings revealed that pre-sowing rainfall, temperature during the nursery phase and rainfall during the grainfilling and ripening phases were positively correlated with rice, while rainfall during the nursery phase, and temperature during the grainfilling and ripening phases were negatively correlated with rice yield. Also, it was discovered that none of the correlation coefficients was significant at 5% level.

The result of this study also indicated that in 1991, 1993, 1996, 1998, 1999, 2000 and 2001, the yield of rice rose above the mean value. On the otherhand, in 1992, 1994, 1995 and 1997 rice yield fell below the means. It further indicated that during the study period, the yield of rice was not highly variable. The value of the coefficient of variation obtained in the analysis was only 26%. The implication of this is that there was neither deficit nor surplus in rice yield in the area but rather rice was fairly sufficient for local consumption during the study period.

In sum, it should be noted that an analytical study of this nature is of immense significance in Nigeria owing to the fact that the issue of food shortages in relation to the increasing population is at stake. Findings from a study of this nature act as an input to agriculture planning tailored towards mass food production.

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