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Articles in the field of agricultural economics, suitable for publication in the journal, will be welcomed.

Articles should have a maximum length of 10 folio pages (including tables, graphs, etc.) typed in double spacing. Contributions, in the language preferred by the writer, should be submitted in triplicate to the Editor, c/o Department of Agricultural Economics and Marketing, Pretoria, and should reach him at least one month prior to date of publication.

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Contents

COMMENTS FROM A RHODESIAN POINT OF VIEW

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Introduction

We have decided to comment only on certain sections of the reports of the Commission of Enquiry into Agriculture. These sections cover aspects of agriculture with which we are familiar, and apply to both Rhodesia and South Africa.

The problem of drought is common to both countries, and appears to be the main cause of variability in agricultural production. Definition of the rainfall climate appears to be extremely important so that farming systems can be adapted to suit different, specific environments. Farm size and the lack of economic viability is another widespread problem. It is usually most evident in areas of unreliable or variable rainfall, where intensive farming systems have been adopted because of obvious lack of potential viability under more suitable, extensive production systems. Such intensive farming practices aggravate the problem because of the inevitable large losses which occur as a result of drought, with additional long-term damage being caused by the devastation and degradation of the veld due to particularly heavy grazing pressures when rainfall is poor. Rainfall variations cause large year to year fluctuations in farm profits in crop producing areas, and there appears to be grounds for the consideration of a crop drought insurance scheme as a means of reducing these fluctuations. Such insurance appears to be feasible for annual cash crops where all the adverse effects are evident during the particular drought season. In the case of perennial crops and livestock enterprises, the adverse effect of a drought may persist for a number of seasons following the drought, making precise calculation of the true extent of the loss impossible.

Recognizing the problem is one thing; clearly the role of the policy-makers and economists should be to encourage farming systems in phase with the environment to ensure sustained, long-term productivity. To this end, the recognition and tabulation of the problem, disseminating information to farmers and encouragement of implementation through correct agricultural policies is vital for the continued growth of South African agriculture. **Ad hoc** development of policies, often for reasons of political expediency, do not encourage a well balanced programme of this nature. The detailed reports of the Commission provide a framework on which sound agricultural development can be based. Many aspects of the report are equally applicable to Rhodesian conditions as for South Africa. It is to be hoped that the initiative and momentum created by this report will not be lost through delays in the administrative process.

1. The problem of drought

The Commission rightly conclude, "droughts of a shorter or longer duration are characteristic and inevitable phenomena, which may be expected to occur with inexorable certainty over large parts of the Republic at least once in five years". [1] A similar situation prevails in Rhodesia, but with only some 40 years of rainfall records generally available, it cannot be definitely stated that the frequency is once every five years. Analysis of the distributions of numerical measures describing effective rainfall, termed rainy pentades, [2] have shown that when the value of this variable is less than the mean less 1 standard deviation, crop and veld production are likely to be very poor. Since measures of effective, seasonal rainfall are normally distributed [3] the likely probability of a severe drought year is therefore one year in six. However, seasons in which the amount of effective rainfall falls between the mean and the mean less 1 standard deviation of the distribution of the particular variable, often turn out to be poor seasons. Seasons in which the measure of effective rainfall is greater than the mean usually turn out to be good seasons with good veld production and high crop yields. There is therefore likely to be a wide range of levels of veld and crop production, the actual amounts being closely associated with the type of rainfall season. In Rhodesia, as in South Africa, there is a tendency for farmers to regard favourable seasons as normal, [4] basing yield expectations and production systems on a rainfall season type which is only likely to occur in one or two years out of six. There appears to be a need for the inherent variability of rainfall seasons to be clearly demonstrated to farmers, so that they can appreciate what is a true normal season, and the range of likely season types. Production planning should be based on rational expectations of the true normal season type.

While the probability of drought years can be estimated from past statistics, occurrence of various season types is random. Each year must be viewed randomly and independently, because even where some 200 years' records are available, as is the case in the American Cornbelt, no pattern of occurrence of a specific season type is discernible. [5] The problem facing agriculture is one of fluctuating returns, and even although some approximate assessment of the probability of drought years can be made, the estimation of the likely production function for the season immediately ahead is made under conditions of uncertainty. The degree of production variation and uncertainty depends on the type of region; in some reliable rainfall areas in Rhodesia, production is almost constant between seasons, while in unreliable rainfall areas, wide variations in production levels occur.

a. Livestock producing regions

In regions where farming systems are mainly based on ranching such as the Northern Transvaal, the North-Western Transvaal and Matabeleland, there is considerable difference in total grass production between different seasons (Table 1). Land which has been cleared of bush produces more dry matter from grass production than uncleared areas, but production is still subject to fluctuation between seasons, although proportionally less than uncleared areas. In this situation, a flexible livestock production policy is desirable so that a farmer can reduce stock numbers in drought years without serious financial loss, thereby being able to adequately maintain the remaining stock on the available grazing. In a flexible ranching system, there is usually a variety of ages and stock types, with production generally being planned for the sale of slaughter stock. There are opportunities during poor seasons for increasing the sales of slaughter-stock, or stock which can be economically slaughtered, thus leaving more grazing available for the breeding herd nucleus. Concentrate feeding of stock to be sold would bring forward date of slaughter or increase the degree of finish, thus improving flexibility. The development of irrigation schemes in these regions for the production of concentrate or fodder could greatly improve prospects for flexibility.

The reports do not specifically mention the need for flexible production systems in the recommendations for the northern, north-western and other cattle ranching regions, [6] and it is considered that measures taken to improve the flexibility of ranching systems could considerably reduce profit fluctuations. Inflexible systems such as ranches organized entirely for sale of weaners only should be discouraged, with the emphasis being placed on systems planned to sell slaughter-stock wherever possible. While a ranching system can be adapted to the modal or average season type to be expected, unless it is sufficiently flexible in being able to off-load stock in bad seasons without serious financial loss, substantial losses are still likely in regions where there are variations in annual veld production. The alternative to preventing losses is stocking at a rate suitable for the worst seasons, but potential profits will be greatly reduced in average or good seasons, and such policies would not give optimal utilization of available resources. Improvement of grazing conditions by additional fencing, extra water supplies and bush clearing where appropriate are likely to considerably improve the productivity of these regions.

TABLE 1 —Comparison of veld production between seasons and between cleared and uncleared areas
Area: TULI (on sandy soils derived from acid gneiss, cleared in 1963)

Year	Seasonal rainfall up to harvest (mm)	Yields in kg/dry matter/ha	
		Not cleared	Cleared
1964	19.1	310	580
1965	269	250	850
1966	322	180	1 620
1967	753	670	3 200
1968	232	240	1 230
1969	316	480	2 060
1970	366	600	1 950
1971	363	680	2 490
1972	688	970	2 840
Mean	389	490	1 870

Source: Barnes, D.L. Bush control and veld productivity. Modern Farming, December 1972.

b. Cropping and mixed farming regions

Crop yields vary considerably between seasons, with variations from the mean being particularly marked in areas having less reliable rainfall (Table 2). Areas used as examples are within regions in which crops are the main source of farm income. Yield variations in marginal cropping areas are considerably greater, and as in South Africa, the range is from very good yields in good seasons to complete crop failure in drought seasons. The economic problem is fluctuating profits, ranging from large profits to crippling losses. Any measures which can reduce yield fluctuation, such as improved technology, will reduce losses, thereby improving long-run profits and farm economic stability. If input levels are set at optimum levels for a modal season type, financial losses will be less than if inputs had been set at optimum levels for an optimistic yield expectation, and a poor season occurs. This policy is particularly important in maize and other crops where a large proportion of factor inputs required have to be committed at the start of a season.

TABLE 2 —Comparison of crop yields between areas and seasons

	Maize Yields in kg/ha				
Year	Yields in reliable area (Doma) kg/ha	Area effective rainfall variable (NP)	Yields in unreliable area kg/ha (Beatrice)	Area effective rainfall variables (NP & LS)	
1964	3 587	12,0	2 220	13,5	21,5
1965	4 596	19,5	2 264	13,0	14,0
1966	4 798	16,5	2 983	13,5	28,5
1967	5 695	18,0	3 946	13,5	20,5
1968	4 125	17,5	1 457	6,5	23,0
1969	5 807	16,0	4 596	17,5	29,0
1970	4 103	19,0	2 466	13,0	31,0
1971	7 003	21,0	4 083	12,0	18,0
Mean (5 yr)	5 346		3 309		
Coefficient of variation (%)	23,0		39,0		

Note: NP = number of rainy pentades per season
LS = length of rainy season in pentades

Source: Area and farm crop yields. Dept. of Conservation & Extension 1972.

The need is therefore for precise definition of the rainfall environment, and of the likely distribution of this defined environment, in order to achieve optimal utilization of the production potential. The Commission recommend that this type of information should be collected. [7] Development of crop cultivars can be greatly assisted by the definition of likely environmental conditions. In Rhodesia, it is only since definition of values of season lengths for specific areas, and the identification of periods of high drought probability, that plant breeders have been aware of the need to concentrate on the development of short season maize varieties of high yield potential, and having better characteristics of drought tolerance at flowering. Prior to this, development had been concentrated on varieties, which, because of a long season requirement, were only suitable for the best rainfall areas. Where the rainfall environment is so poor that crop production is identified as hazardous, e.g. in Matabeleland or in the North-Western Transvaal, cash crop production should be discouraged, only being recommended if specific, drought resistant crops can be economically produced under low cost production regimes.

Current pricing policies, certainly in Rhodesia, and possibly also in South Africa, tend to encourage ill-advised production of unsuited crops. For example, Rhodesian maize price policy, which provides a single, national price to the producer, is considerably lower than the controlled purchasing price for the consumer, encouraging farmers in unreliable areas such as Matabeleland to produce maize for home consumption, provided that the cost of production is lower than the purchase price. There are probably other examples of inconsistent agricultural policy which should be investigated and if possible, eliminated. The question is whether farmers should be coerced or encouraged to adopt adapted farming systems. For example, farmers in Matabeleland are currently behaving in an economically rational manner in producing their maize requirements. Coercion without adjustment in price policy is likely to create economic hardship, while not ensuring development of situations of comparative advantage.

Where a sound basis of statistics of farm yields can be developed as recommended in the Final Report [8] opportunities arise for comparison of area yield data with rainfall data. Hoewever, as pointed out, [9] annual averages are of little value, and actual distributions of precipitation for periods shorter than one year are required. The World Meteorological Organization has proposed the use of a five day period or pentade as a standard period of recording rainfall. Griffiths [10] has proposed a method in which certain pentades are defined as 'rainy' if they satisfy a certain criterion. This criterion is assumed to indicate a measure of rainfall effective for crops, eliminating the influence of very heavy and very light falls. While the method of classification is relatively crude compared to more sophisticated methods involving detailed calculation of evapotranspiration, precititation, infiltration and soil water balance according to soil and plant types, it does appear to produce useful results. Lineham [11] proposed that this classification system could be used to define season length as the period extending from the first to last rainy pentade, and season quality as the number of rainy pentades occurring within a season. Seasons can then be compared for specific areas, and distribution parameters calculated. In addition, differences between areas become obvious, indicating those areas suitable for sustained, intensive crop production and those more suitable for extensive production systems.

Using the rainy pentade system of rainfall classification, seasonal rainfall can be described numerically by two variables, season length and number of rainy pentades. Distributions of each variable have been found to lie within the statistical limits of normally distributed variables. [12] Probabilities of occurrence of specific values or greater can then be calculated according to the areas under the standard normal curve. The data can then be compared with area yield date to determine relationships with area crop yields. Where significant correlations are found to exist, probabilities of area yields equalling or exceeding specific levels have the same values as the associated rainfall variables determined in multiple regression, where the regression model contains only one rainfall variable, i.e. either NP or LS.

TABLE 3 —Comparison of rainfall conditions in a number of areas of Rhodesia (data listed in pentades)

Area	Type (rainfall)	Av. season standard deviation length	Av. number standard deviation of rainy pentades	Av. NP as % of av. LS
Banket	Very good	25,7 4,4	20,3 4,0	76,0
Salisbury	Good	26,5 3,5	18,9 4,1	71,0
Wedza	Poor	26,4 5,6	16,3 4,0	61,7
Ft.Victoria	Very dry	21,6 5,9	9,7 3,3	44,5
Beitbridge	Arid	10,9 8,2	2,2 2,2	20,2

Source: Rhodesia Dept. of Meteorological Services.

Multiple regression of 20 years of rainfall data on area yields gave the following result for the Doma area:

$$Y = 52{,}51\ YR - 475{,}04\ NP + 8{,}02\ YN$$

where Y = predicted yield
YR = year effect, e.g. 1972 coded as 72
NP = number of rainy pentades
YN = interaction effect of YR and NP

(Significance levels F 0,05 $R^2 = 0{,}98$, sig. at 0,01.)

Estimation of the probability that area yield will equal or exceed a certain level can be made by determining the value of the required probability from the NP distribution, and then substituting in the model for year and NP value.

Probability that NP will exceed value of 15,3 = 90%

Associated yield 5 345 kg/ha

Probability that NP will exceed value of 20,5 = 50%

Associated yield 5 880 kg/ha

Estimation of probability becomes more complex if two rainfall variables are included in the model, arising if season length is also of importance as well as number of rainy pentades. Using the example of Beatrice (Table 2), multiple regression of 20 years of rainfall data on area yields gave the following result : [13]

$$Y = -602{,}32YR + 7{,}34YR^2 - 1\,017{,}34NP + 1\,783{,}04LS + 28{,}49\ YN - 22{,}22YL - 26{,}09NL$$

Y = predicted yield — Interaction
YR = year effect — YN = YR × NP
NP = number of rainy pentades — YL = YR × LS
LS = season length in pentades — NL = NP × LS

(Significance F 0,05 $R^2 = 0{,}98$, sig. at 0,01.)

Determination of the joint probability of two correlated, normally distributed variables, i.e. NP and LS, are computed by numerical integration of a bi-variate normal distribution. [14] Probabilities of area yields can then be estimated for relatively small geographical areas such as intensive conservation areas of approximately 100 000 ha in extent, within which soil and rainfall conditions are fairly homogeneous. Predicted yields are made under conditions of existing technology, but yield trends can change through the widespread adoption of improved technology such as the change to a new, improved crop variety, or through changes in crop husbandry methods which make better use of the bio-climatic conditions identified.

The above procedure outlines the methods which can be adopted in Rhodesia for the estimation of risk in crop production, suggested as being necessary by Tidmarsh, and quoted by the Commission. [15] The results described would appear to strengthen the Commission recommendation for the establishment of a central unit for the processing of climatic data [16]. This unit should be supplemented by the development of an efficient system of collected and recording crop yield statistics so that similar correlations to those described can be attempted for South African conditions in order to determine yield probabilities and yield trends.

Once risk has been determined, an interesting new field opens up for the economist in which random yield simulation techniques can be applied for specific areas according to the yield probability distributions. Different cost strategies with associated maximum yields can be selected in order to determine optimum strategies for long-run profit maximisation. It has been noted that strategies in unreliable rainfall areas in Rhodesia which lessen the number and size of negative gross margins result in the highest long-run profits. High cost strategies which can produce very high profits on the rare occasions when rainfall is favourable, produce the lowest long-run profits because of the large losses associated with drought years. [17] This finding strengthens the general recommendation of the

Commission for the use of optimal systems or resource utilization within specific environments.

The above comments have been made using area average yield as the measure of yield. It is however widely recognized that a range of management levels exist within specific environments, some farmers being able to achieve good profits or yields, while others under the same conditions do badly. [18] The extent of the variation of yields in Rhodesia is such that there is greater variation between farmer yields within specific areas than between year to year variations in area yield. [19] In all analyses involving area average yields, an adjustment should be made to allow for this wide variation in performance. In the long term, attempts should be made to identify possible causes of this wide variation as a means of improving production levels.

2. The problem of farm viability

The problem of uneconomic farming units in both Rhodesia and South Africa is widespread, being particularly marked in areas where the productive potential of land is low. In Rhodesia, it is mainly in the dry, ranching areas that these non-viable farming units appear to be most numerous. Definition of a non-viable farming unit is difficult, but it can be broadly assumed that if all the farm resources are fully utilized under the prevailing farming system of the region, and that these are incapable of providing the farmer with a reasonable living under good management, the farm is an uneconomic unit. Lack of capital or expertise by the owner may limit the productive capacity of an economic farming unit; this does not constitute a problem, except for the individual involved, because there are usually plenty of new or existing farmers with adequate capital and expertise who are keen to take over the unit, and utilize it to its fullest extent.

The level of profit or entrepreneur's return estimated to be the minimum level required for viability is difficult to establish. In South Africa, the level used is R1 500 per annum, with an estimated 34 per cent of all full-time farmers having a farming income less than this figure. [20] In a recent survey of Rhodesia, using as the criterion of economic viability the potential for making a net profit of $4 000 per annum, utilizing the recommended farming system for the particular area, the percentage of non-viable farming units was considerable (Table 4).

Within the large group of operators on non-viable farms, there were clearly many, who, in the estimation of the local extension staff, were making a living of more than $4 000 per annum for a number of reasons:

a. Operators who were able to make very high profits because of a very high standard of management, or had very low overheads because of a high level of personal equity in the business, or through a combination of good management and high business equity.

b. Operators who made a living of over $4 000 per annum because of additional non-farm income through employment off the farm by the farmer or one of his family, or by receipt of pension or investment income. Also in this category were a number of farmers who were content with a farm income of less than $4 000 per annum because they were able to live cheaply off the farm and had relatively simple needs. It was only on some 20 per cent of all farming units that acute problems of lack of viability appeared to exist. In these cases, an income of $4 000 was required but could not be made by the full utilization of all resources under a reasonable standard of management.

TABLE 4 —Assessment of the economic viability of farming units in four provinces of Rhodesia

Province	Total no. of units	Non-viable units	Per cent non-viable %	Non-viable units in difficulty	Per cent of total units %
Manicaland	667	380	57,0	130	19,5
Matabeleland	951	228	24,0	166	17,5
Midlands	755	246	32,6	176	23,0
Victoria	364	170	46,7	66	18,0

Source: Robertson, W.R. (1973). Proc. of symposium on farm viability, Rhod. Agric. Econ. Society.

There are two aspects of the problem of farm viability. Firstly, steps should be taken to prevent the situation becoming worse by immediately stopping the further fragmentation of agricultural land. The Commission rightly recommend that the control of the subdivision of agricultural land should be exercised by one of the Departments of Agriculture who are in a position to determine the economic viability of the subdivision and the remaining extent. [21] It has been the practice in Rhodesia for many years for the Ministry of Agriculture to control all subdivision of agricultural land, with approval only granted if a potential exists for a profit of over $4 000 per annum to be made on both the subdivision and the remainder, utilizing recommended farming system. Profitability is based on economic standards derived from area average yield data and average production costs, applying a standard figure for farm overheads.

Secondly, the problem of non-viable units and poverty of the operators should be immediately tackled.

This aspect is considerably more difficult than the prevention of further fragmentation. In the past, this problem appears to have been over-simplified by the statement "get big or get out", and a more comprehensive approach is required. The objectives are twofold and conflicting: to maintain the maximum White settlement on the platteland, and to provide those living there with the opportunity of making an adequate living. Farm consolidation as a means of agricultural adjustment is being applied in many countries, notably France and Australia, and special schemes enable able farmers to enlarge their units by taking over units of those quitting farming. The alternative is to make possible and to encourage part-time farming where possible, so that the operator has the opportunity to supplement the farm profit through income from employment. While it is not suggested that land be cut up for part-time farming, those existing operators in areas where employment can be provided should be permitted to take up non-farm employment without in any way jeopardizing any existing financial arrangements such as a Land Bank loan.

The Agricultural Finance Corporation in Rhodesia is now prepared to consider lending to part-time farmers for purposes of farm improvement and for expanding holdings, each case being judged on its merits. It is not proposed to institute a scheme to lend funds for those who wish to take up part-time farming, lending being confined to existing, sound part-time farmers.

The human problem of moving rural people off the land and resettling them in towns is considerable, and the comments made by De Swardt are considered to clearly describe the extent of the problem, and the general recommendations for tackling this vast problem are sound and worthy of full investigation. [22] A gradual process of farm consolidation appears inevitable in the more remote and extensive farming regions, and steps should be taken to facilitate this adjustment. In particular, a haphazard evacuation of uneconomic units should be avoided as recommended. [23] Where possible, the provision of employment opportunities for part-time farmers would assist in stabilizing the situation. Prevailing personal attitude of several agricultural economists in the U.S.A. is that rural slums are far preferable to urban slums.

Where consolidation is inevitable, special financial assistance is likely to be necessary, both for the farmer with a satisfactory standard of management expanding his operations, and for the farmer quitting. For the farmer expanding, additional capital for land and stock purchase is likely to be needed, and in many cases, working capital as well. Those farmers assisted to expand should be obliged to follow recommended systems of farming, complying with all relevant soil conservation measures as a condition of being granted special loans for farm consolidation. Farmers quitting need to be able to realize all capital assets to be immediately available to assist in resettlement in urban or peri-urban surroundings. Job training is also necessary if the farmer is young enough to take up alternative employment, and assistance for living expenses during this period, following the Australian pattern, would appear to be highly desirable.

The major fault in agricultural lending by Land Banks during the last decade has been the over-emphasis of the security of the market value of the farm, often greatly inflated because of market pressures. This has led to excessive lending in relation to the productive capacity of the farm. It is therefore encouraging to note that the Land Bank in South Africa, like the Agricultural Finance Corporation in Rhodesia, is now paying particular attention to the repayment capacity of the farm resources under the correct type of utilization. [24] It is no solution to lend against the security of a farm, and assume that if one farmer cannot meet the required repayment schedule, the farm can be transferred to another who can. If the farm is basically non-viable, no farm operator is likely to be able to carry an excessive debt load and make a decent living. Particular attention should be devoted to tailoring repayment schedules to suit individual circumstances.

Other lenders should be encouraged to prevent the encouragement of the survival of uneconomic holdings by excessive lending against some unrealistic security level. [25] In many cases, uneconomic holdings are taken over by potential farmers with little or no experience of farming. What may appear to them to be a large farm is in reality an uneconomic unit. There is little that can be done to prevent the sale of uneconomic unit. There is little that can be done to prevent the sale of uneconomic units to inexperienced farmers, other than to publicize the advisability for all those considering farming to seek a professional opinion as to the potential viability of a particular farm. This is in effect protecting potential farmers from making unwise decisions because of lack of knowledge; it is far easier to prevent a potential farmer taking over an uneconomic unit than to get him out of the financial difficulty he will be in once he has discovered for himself that he cannot make an adequate living.

3. Crop insurance as a means of overcoming the problem of farm income variability

In both Rhodesia and South Africa, yield variations occur mainly as a result of drought. Other natural catastrophies such as hail, frost and windstorms cause damage and crop loss, but the extent is usually relatively minor from the national point of view, and the damage confined to relatively small areas. Ray outlines the problems which arise in crop insurance, stating that as the probability of loss approaches 100 per cent, or that losses are very infrequent, insurance is inappropriate. [26] Insurance is likely to be most suitable as a means of reducing income variability when the probabilities of loss are substantially less than 50 per cent.

In maize yields in particular, the probability of loss is often about 50 per cent, therefore appearing to be a rather poor subject for insurance. For an insurance scheme to operate satisfactorily, risk should be fortuitous, measurable in large numbers and within the means of the average farmer. Insurance is most suitable when the risk is low and the amount at stake high. In crop insurance, the reverse is usually the case, the amount at stake individually per hectare is low and the risk relatively high.

In Rhodesia, drought relief payments have been made to farmers experiencing loss because of drought in three out of the last six cropping seasons. Disadvantages of drought relief assistance, which is based on losses incurred, is that many inefficient producers, who would without drought relief be forced to quit, are maintained on the land. Efficient producers are usually less seriously affected by drought and generally receive proportionally less aid. However, in the present 1973 drought relief scheme, the method of calculating the level of assistance has attempted to provide assistance according to past yield performance, so that those farmers who have consistently had high yields in the past receive proportionally more assistance than producers with low average yields. Assistance is calculated according to standard variable costs for specific yield levels, based on regression of yields on variable cost data. A high yield producer is therefore likely to receive a higher level of compensation than a low yield producer.

Livestock drought relief has also been provided but the assessment of the actual loss has been extremely difficult. Since livestock insurance is not considered feasible, this emphasises the need for adaptable and feasible livestock production systems in the less reliable rainfall areas.

Drought relief schemes are unsatisfactory from the point of view of both farmers and government. In the case of the farmer, there is no prior knowledge whether drought relief will be forthcoming, and in the case of government, no satisfactory estimate can be made of the final cost. Crop insurance would appear to be the logical alternative in which a farmer can be certain of a minimum level of indemnity. If a voluntary scheme was available for farmers to insure against drought hazard, it would be open to government to contribute to the fund in place of drought relief, possibly stating that only those farmers who insured would receive drought relief in the form of subsidized crop drought insurance.

In both South Africa and Rhodesia, maize appears to be the crop for which drought insurance is most necessary. As suggested by the Commission, a drought insurance scheme should start with only one crop, with cover gradually extended to other crops in the light of experience gained, and as the base of statistics is broadened. Insurance must promote sound, well adapted farming systems, and in general should pay its way if possible. [27] In Rhodesia, there appears to be justification for government to contribute an annual sum, proportional to that contributed by the farmers, because of the precedent of drought relief. This subsidization is particularly important because of the need to encourage crop insurance, and to assist in covering administration and inspection costs. A well established farmer would not be likely to insure since he could cover his own drought losses more cheaply from his own resources, rather than contribute to a fund which had to bear administration and inspection costs. Some degree of subsidization therefore appears an essential prerequisite in any drought insurance scheme to encourage participation by established farmers.

Calculation of risk for drought insurance requires a sound base of crop yield statistics, [28] stressing the need for the building up of a comprehensive base of agricultural statistics. It is evident that the level of compensation should be matched to the potential performance of the individual farmer, and not as is common in America in which the practice is to set the indemnity level at a proportion of area yield. [29] In Rhodesia where the coefficient of variation of the distribution of farmers' maize yields within specific areas averages between 35 and 50 per cent, compensation levels based on the area average yields would be unattractive to the top third group of farmers, and excessively high for the bottom third. [30] For general acceptability, indemnity levels should be based on individual performance, the best method being actual past yields achieved by individual farmers. [31]

The Commission does not state the level of support considered necessary. American practice reported shows a range of from 50 to 75 per cent of average yields as the level of indemnity. Calculations made for maize production in Rhodesia at the 75 per cent level appear to be adequate to cover variable costs at average and above average yield levels. It is assumed in crop drought insurance that the objective is to cover variable costs only; the farmer still incurs a loss since he has to meet overhead costs and living expenses.

Determination of the yield deviation from the 75 per cent level is the actual loss incurred, and the average of a number of years losses will provide the 'loss-cost' or pure risk. The actual loss, expressed in units of production, e.g. bags of maize, can be adjusted to take account of possible price fluctuations. In an analysis of average loss-costs per area over 14 areas, the range was from $5,45 to $10,58 per hectare, but individual loss-costs ranged from zero to as much as $17 per hectare, calculation being based on a maize price of $27 per ton.

The indications are that where the risk of drought is very low, farmers will be disinclined to insure, and where the risk is high, reluctant to pay the high premium required. A large subsidy on crop insurance could have the effect of encouraging cropping in unsuitable areas. The inherent problem in regions where the drought risk is high, i.e. approximately a probability of 50 per cent, is that the cost of premiums is relatively high in relation to possible loss, demonstrating that in high risk regions, crop yields are not a suitable subject for insurance. Attempts should still continue to find a means of providing a workable crop insurance scheme, despite possible defects, so that crop farmers have the opportunity to reduce profit variability.

Since the occurrence of poor yield is random, there is a possibility of acute difficulty in the early years of a crop insurance scheme should there be a series of drought years. Unless reinsurance cover can be negotiated, a limited liability insurance scheme can only be provided, with the total indemnity limited by funds available. If the indemnity level proved to be very low in relation to the loss incurred, future prospects for crop drought insurance could be seriously damaged.

Conclusion

The three reports of the Commission of Enquiry into Agriculture have assembled a wealth of information on the problems of agriculture in South Africa. The conclusions and recommendations are considered to offer sound advice on means of overcoming the many problems. The strong emphasis on the need to adapt farming systems to the environment is very justified, especially because of the widespread use of unadapted and unsuitable farming systems. Unless significant improvement in farming systems can be achieved, and there is adjustment of rural agricultural population, further damage to the natural resources of South Africa will take place, intensifying the present problems.

The need for improvement in the general managerial level of farmers is clear, and this need is widely accepted by most extension workers. The difficulty is likely to be one of cummunicating this need to the people concerned, the farmers themselves. Farming is still looked upon as a way of life, and until this outlook is changed through education, there will not be rapid improvement in farm business management. Pressure on farmers who obtain financial assistance from government sources for unit consolidation to improve methods of business management is justified.

The need for adequate and up to date statistics on all types of agricultural production, and on production costs, cannot be over-emphasised. What is probably equally as important as the setting up of processing bureaux, is obtaining the willing co-operation of farmers in the provision of accurate and punctual returns. It may also be necessary to launch schemes to educate farmers in the likely benefits which will accrue to them from such statistics, and in the correct method of rendering returns. It therefore appears that a function of agricultural extension is to demonstrate to farmers the need for collection of statistics over a large proportion of the farming population, and to train farmers in correct methods of completing statistical returns.

Finally, overall agricultural policy should be based on principles which enable consistency and flexibility in the development of farming systems compatible with the environment. Much can be said for the reports forming the basis of development of such policies, provided that action and implementation are sustained at all levels. It is hoped that discussions at this conference have added momentum to implementation of the recommendations.

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