

UNITED NATIONS DEVELOPMENT PROGRAMME
(SPECIAL FUND)

SURVEYS AND TRAINING FOR THE DEVELOPMENT OF
WATER RESOURCES AND AGRICULTURAL PRODUCTION
BOTSWANA

Technical Note No 4

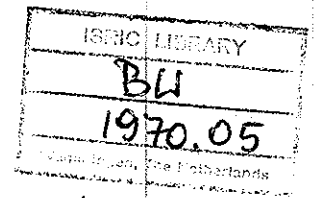
Report following a Visit to the Project, 6 - 22 April 1970

by

I.G. SIMPSON

Consultant Economist

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UNDP (SF) Project 359. Surveys and Training for the Development of Water Resources and Agricultural Production - BOT/1

Report following a Visit to the Project, 6th to 22nd April, 1970

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Terms of Reference:-

"In his visit to the project, the Consultant Economist would advise the Project Manager and the recently arrived Agricultural Production Economist on detailing a work programme in the economic sector of the project, e.g. discussing initial feasibility studies and surveys to be undertaken by the Agricultural Production Economist".

Programme of Visit:-

Throughout his visit the Consultant Economist was able to work closely with Dr. Quintana, the Agricultural Production Economist and his assistance and co-operation is warmly acknowledged. The period 6th to 10th April was spent at Gaborone and discussions were had with such project members as were available and with a number of Ministry of Agriculture officials. From 10th to 14th April was spent at Mahalapye where there were opportunities to have discussions with other project members, particularly the range ecologist and the irrigation agronomist and to visit some of the farms in the recording scheme established by Dr. Quintana. Following the return to Gaborone, proposals for future studies were formulated and these were discussed at length with Dr. Quintana and those responsible for the sociological studies and agreement reached as to the forthcoming programme of work, which was endorsed by the Project Manager.

The Scope of Activities in Agricultural Economies within the Project

The principal activities of the Agricultural Production Economist with such assistance as may be available to him in this field, are likely to fall under the following headings:-

- (1) The conduct of economic investigations within the study catchment.
- (2) Participation in the preparation of the Land Use Plan Report for the study catchment using material from the above investigations.
- (3) Collection and analysis of data from the pilot irrigation schemes at Kasane and elsewhere which are to be developed by the Project.

- (4) Participation in the formulation of water development projects in the Northern Region.
- (5) Collation and interpretation of existing and future material on the economies of agricultural production and marketing in Botswana having regard to the commitment in the revised Plan of Operation to formulate guidelines for agricultural development in the Eastern Region (recent studies are listed in an appendix to this report).

Activities under these headings are discussed in more detail below following brief reviews of the situation in respect of each of the main areas of concern to the Project.

Following the visit of the Review Mission earlier this year, the need has been emphasised for the social and economic studies of the Project to be integrated with similar work being undertaken in the Ministry of Agriculture where a Planning and Economics Section has recently been formed. The Project staff concerned with these duties will shortly be moved to offices in the Ministry of Agriculture. It will obviously be an advantage for the Project members to participate in discussions within the Ministry, particularly those in respect of the land use studies in the Metsmotlhaba catchment and those now being initiated at Ramaquabane, while the Ministry staff will similarly be able to contribute on areas of concern to the Project. So far as detailed investigations are concerned, however, it would seem desirable that Project members should concentrate on those areas for which the Project has specific responsibility rather than undertake such investigations on behalf of or in association with Ministry staff. The short time period left to the Project makes this restriction particularly necessary.

The Study Catchment

General Observations:-

Economic investigations in the study catchment need to be related to those already being undertaken by the soil surveyor, hydrologists, range ecologist and rural sociologist so that the results of all the investigations can be brought together in the Land Use Plan Report. This report should detail the present resources of the area in terms of land capability, grazing potential, water resources, human population, livestock and durable assets. The present uses of the resources should be described and an indication given of the extent to which these meet the minimum needs of the population. The consequences of the continuance of the present

pattern of resource use in a situation where the rural population both continues to expand and to desire higher incomes will need to be spelt out with an emphasis on the extent to which resources are being depleted. Possible alternatives for future development should be described together with the constraints, particularly those relating to social and institutional factors, which may hinder the implementation of such alternatives. Means of overcoming the constraints will require consideration with preference being given to the adaptation rather than complete replacement of existing institutions. The costs involved in the proposals will need to be stated and estimates made of the likely accruing benefits.

The existing low productivity of resources in the study catchment is very apparent but there does appear to be some scope for marked technical advances even given the difficult climatic regime. It has been suggested that given proper range management, stocking rates could be greatly increased and the use of moisture conserving cultivation techniques may lead to higher crop yields - (interesting work on this subject has been undertaken by G. Nielson and V. Gibberd). The development of low cost cultivation techniques as an alternative to the present rather costly ploughing could lead to an extension of tractor use as a means of raising productivity through higher crop yields, an extension of the areas cropped and a higher cattle take off with the large teams of draught oxen no longer required (on the Sedibong unit farms, the cattle revenue foregone by using draught oxen rather than tractors for ploughing is estimated at nearly 3 rands per acre). In low rainfall areas where crop yield potentials are low, higher productivity per man may essentially depend on an increase in the area cultivated. Realisation of the benefits of tractor use would, however, be dependant on finding a form of organisation giving a full utilisation of tractor capability without inflated costs.

There is considerable evidence that the improved practices recommended by the extension service raise productivity but there may be doubts as to the adequacy of the present approach for future needs.

Without improved techniques and given the present pattern of land holding, the scope for significantly raising incomes either individually or collectively by changing the balance of farm activities as between livestock and crops or between different crops is probably very limited. The uncertainty of returns is a major but not easily quantified factor here. At present the major proportion of the output of Botswana's agriculture comes from cattle with crops having a subsidiary role. On the basis of the 1968/69 Agricultural Survey cattle output outside

the Freehold Blocks would appear to have been of the order of 4 million rands while crops amounted to less than 1½ million rands. As regards employment, it might be anticipated that the major demand comes from crops and in view of this and their considerably higher output per acre as compared with cattle, an expanded crop area would seem inevitable to meet income and employment goals.

The evidence of the Agricultural Survey and of brief visits to the study catchment suggests a fairly skewed distribution of wealth in the rural areas. At Kalanare there are holdings with several hundred acres under crops. This uneven distribution may well present particular problems in development and deserves study in the local context.

In the short run, the essential need may be to obtain local acceptance of conservation measures which benefit the community in the long run rather than the individual in the short run. The mapping and registration of lands would enable new land grants to be allocated in accordance with the principles of satisfactory land use while limited enclosure of grazing areas might be envisaged to provide co-operative fattening units on the lines of the Agricultural Demonstration Ranches.

ECONOMIC INVESTIGATIONS:-

The Rural Sociologist has undertaken a complete population survey of the study catchment and has recorded a population contained in approximately 1400 households. His enumeration team is at present engaged in an agricultural survey involving the completion of a single interview questionnaire on general aspects of farming activity and including for a sub-sample of 10% of households, a record of annual crop and livestock production. The agricultural survey was intended to be followed by a comprehensive income and expenditure survey extending over a full year. These studies will all be of considerable value but would still leave areas for which more data would be required for economic evaluation particularly in respect of labour use, distribution of cropped areas and in crop area and yield estimation. Insufficient emphasis would be given to the year round economy of the individual agricultural units. A recording scheme covering all agricultural activities over a full year would meet these additional requirements and Dr. Quintana in fact has made a limited start with recording on nine selected holdings (three operated by tractors and six by oxen). This number is not however adequate for analysis in depth and Dr. Quintana proposed supplementing it with a single interview farm business survey coupled with crop area and yield measurement on a sample of 30 to 50 holdings. However, if the resources could be found, an extension of

the full recording scheme would provide results of considerably greater value. With this in mind, the proposal was made that the agricultural recording scheme might be combined with a modified income and expenditure survey. This proposal was agreed to. The combined scheme will avoid duplication, permit some cross checking between production and consumption and lead to the full utilisation of the effective enumeration team set up for the sociological studies. A random sample stratified by location will be used drawn from the study catchment households and recording will be on the basis of regular weekly interviews - it is thought that this frequency will be adequate given the rather simple type of economy. Details of income and expenditure, production and consumption, and labour use will be recorded together with area measurement of cropped lands. The sample may include up to 180 households but with the wide scatter of population it may well be necessary to reduce this number. Full recording will be confined to those households within the sample that are engaged in significant agricultural activities. It is intended to commence in July, 1970. A number of forms were drafted by the Consultant Economist as guidance for drawing up the final recording forms.

The carrying out of this combined investigation will not be easy but the Project's resources in terms of personnel are such that it should be carried to a successful conclusion. The integrated approach to the economic activities of the population of a restricted area will be something not yet attempted in Botswana. Analysis of the data will require careful advance planning particularly in view of the short period between the conclusion of the survey (June 1971) and the dates scheduled for report preparation (November, December 1971). Some of the economic relationships which may be established include income levels and their spread, interactions between scale of agricultural activity, technology and efficiency in terms of factors such as cattle turn off, crop yields per acre and labour input per unit of output. The possibility of analysing the data by computer should be discussed when the computer systems expert visits the Project, but in view of the nature of the data and the lack of repetitiveness this may not be justified at least as regards the primary data.

KASANE PILOT IRRIGATION SCHEME

General Observations:-

The Project is to participate with the Ministry of Agriculture in setting up a 100-acre pilot irrigation scheme at Kasane. This location although remote has a number of advantages as the site for the pilot scheme. There is a good supply of perennial water,

scope for an early expansion to 1500 acres with possible further expansion to the south later and a relatively high rainfall which will reduce pumping costs. Although the existing population is low, labour availability will probably not be a major restriction given the limited size of the irrigable area. Most of the produce will have to be sold in Zambia until the Nata to Kazungula road is built and even then the shorter distances may still favour export. The market outlets in Zambia appear reasonably favourable in the short term.

THE SMALL DEMONSTRATION IRRIGATION UNITS

General Observations:-

In spite of the general scarcity of water in the Eastern Region, there are apparently a number of locations where small scale irrigation is likely to be possible. The future scope for such irrigation, however, will be subject to the competing demands of other forms of water use including that for livestock, which give a higher return per unit of water utilised. It is difficult to conceive of centralised development, planning or management in respect of these small schemes and their development is likely to be a matter for local initiative aided by outside assistance from government sources in respect of credit, and of advice on technical and marketing aspects. It is anticipated that the Project will have 5 acre demonstration units in operation at Mahalapye and Vukwe by the end of May, a unit at Mogobane when water becomes available and probably another at Rakops on the Botletle River. In view of the demonstration function of these units, it would seem desirable to incorporate the simpler techniques of irrigation as well as the use of sprinkler equipment in that the former may require less sophisticated skills for their operation and maintenance. The economy of sprinklers in water use could be offset by faulty use of the equipment and the reduction in net returns on account of higher fixed charges. On the Lobatse units, the savings in water use on the sprinkler as against furrow irrigated crops were not very large*.

There has been a tendency to think in terms of these small units concentrating on the production of vegetables but the local demand is likely to be limited while the marketing problems may be considerable.

	Sprinkler	Furrow
* cotton	20.4"	24.7"
maize	13.1"	11.95"
groundnuts	13.5"	13.3"

Traders are unwilling to change from their traditional suppliers on account both of the credit given by them and the uncertainty of obtaining the same continuity and range of supplies from alternative sources. Contracts with institutions offer perhaps the most immediate opportunities as regards market outlets and the desirability of such contracts being established might be publicised. Crops other than vegetables such as maize or rice may give comparable returns with vegetables if grown on a specialised high yield basis. The experience of the Chinese on their irrigation farm at Gaborone should be utilised and details requested of :-

- a) Per acre yields of the crops grown
- b) Varieties giving the best results
- c) Use and cost of fertilisers, insecticides, and other materials used on a crop by crop basis.

It is proposed to allocate half of the Chinese farm to local settlers on the basis of one acre plots. The possibility of records being obtained from the settlers might be explored.

Economic Investigations:-

All the Project irrigation units should be recorded. A draft was prepared for a weekly record covering operations undertaken together with labour and water use. The responsibility for completion of these forms and their return to the office should be that of the demonstrators in charge of the units. At the end of the first year of operation, a summary of the performance of each unit would be prepared including a calculation of the net return relative to the capital invested and quantity of water used.

DEVELOPMENTS IN THE OKAVANGO REGION

General Observations:-

There is still much hydrological and survey work to be undertaken in the Okavango region and in the near future, irrigation developments may be confined to schemes involving the regulation of water flow into the shallow flood valleys (molapos); which adjoin the major watercourses by the means of low banks plus perhaps the development of small pump units. The pressing need at present is to get water from the swamps to the diamond mine at Orapa. Regulation of the water flow on to the molapos will reduce seepage losses and so increase the flow in the mainstreams while reducing the periods of waterlogging. The high Ph. of the soils and resulting trace element

deficiencies may however keep down yields so that while costs involved // may be low; the benefits are also likely to be modest.

In view of the very low population density of Northern Botswana it seems inevitable that irrigation in this region will have to be extended comparatively slowly to give time for an inflow of population and the build up of infrastructure. This, however, should not detract from the long term need for larger developments and it is hoped that within the life of the Project it will be possible to identify and indicate the magnitude of the potential for such developments.

Economic Investigations:-

At present there is no justification for detailed economic investigations in this area but it is recommended that one or more reconnaissance visits should be made, in order to obtain rather more detail than that available in the Agricultural Survey records.

FACILITIES FOR THE AGRICULTURAL PRODUCTION ECONOMIST

Dr. Quintana will need to undertake considerable travelling to supervise the various recording schemes and for reconnaissance trips such as mentioned above. It will therefore be essential that he should have better transport facilities than at present. It is in fact understood that one of the new Project vehicles will be permanently allocated to him. With the combined survey to be undertaken in the study catchment, additional enumerators beyond those in the present team should not be required, but additional clerical staff is likely to be needed for the tabulation and analysis of the data from this survey and of that from irrigation scheme records. Dr. Quintana's request for the appointment of a counterpart is supported and it is understood that a suitably qualified Motswana will be joining the Ministry of Agriculture later this year.

It would seem desirable that Dr. Quintana as the sole full time economist on the Project should attend meetings at which future developments are discussed with representatives of the interested departments.

FURTHER PARTICIPATION BY THE CONSULTANT ECONOMIST

The Consultant Economist might be able to make a further contribution of value to the Project's activities at the stage when the preliminary results of the analysis of the data from the study catchment and irrigation schemes become available. Discussions could then take place on the more detailed analyses required and on the preliminary outlines of the agricultural economics and land use plan reports.

If present plans are adhered to, such discussions might take place during a visit between August and October, 1971. A brief visit at an earlier date to ascertain the progress of the surveys and to prepare a programme for the later consultations would also be of value.

As stated in the report made after the initial visit to the Project, it would be very helpful in keeping in touch with the Project's activities to have copies forwarded of the Project manager's semi-annual reports.

APPENDIX. Recent and Forthcoming Studies on Economic Aspects
of Agriculture in Botswana

A. MINISTRY OF AGRICULTURE

1. National Agricultural Surveys:-

Reports are now available on the 1967/68 and 1968/69 sample census surveys. Both give details of crop areas and yields, livestock numbers and changes including for 1968/69 an estimate of the value of stock disposed of, and of ownership of implements. The sample census is being repeated in 1969/70 with a reduced sample of 45 enumeration areas as against 83 previously. The small proportion of holdings sampled (approximately 2%) and consequent high sampling errors for some items must be remembered in using the results of the two earlier surveys. In 1968/69 the freehold farms were enumerated for the first time on a 100% basis.

2. Unit Farms:-

Two unit farms operated on a single holder basis but with directed management were initiated at Sedibeng in the Barolong in 1966 and four seasons' results are now available together with those from six adjacent private farms. One unit farm is operated with oxen and the other by a tractor. The advantage, particularly as regards crop yields, has been with the tractor unit. The tables published by Jackson and later by Halkon give per acre yields, gross output, cash costs, total labour inputs. Seasonal labour inputs have been ascertained but are not shown on the summaries. Halkon has carried out a simple linear programming exercise for the ox unit.

Jackson initiated two irrigated unit farms at Lobatse in 1968, each of 5 acres, one with sprinkler and one with furrow irrigation and supplied from a borehole. The units have now been closed down owing to lack of water but as already mentioned the information derived from them is of considerable value. Labour requirements were considerably higher with furrow irrigation but there was probably scope for improvement in the method used.

Two unit ranches have also been operated, one in the South and one in the Northern State lands. In one note, results were said to be satisfactory in the South but not in the North.

3. Farm Recording Schemes:-

36 farms at Molepolole, Kanye and Sedibeng will be recorded on a detailed basis for the 1970/71 season under the supervision of Mr. Halkon. This work is linked with that of unit farms and the survey used by Lever.

4. Mogobane:-

G.F. Jackson analysed the Mogobane records for 1968/69 and prepared a detailed analysis of crop yields and returns and of monthly labour inputs. Dr. Quintana now has the tables which were prepared by Jackson, and given to me on my last visit.

5. Marketing Survey:-

This has been conducted by Miss G. Cole and is based on single interviews with a random sample of extension scheme and non scheme farmers. She has also obtained data from traders. Her report should be very valuable. She hopes to complete it by June.

6. Tractor Survey:-

This has been organised by W. McGinley at Mahalapye and covers all owners of agricultural tractors. A brief questionnaire has been completed by agricultural demonstrators and a more detailed follow up is now being undertaken by a volunteer. McGinley hopes to complete a report on the survey by August or September of this year.

7. Moshupa Survey:-

This was carried out by the National Survey team covering all holders (about 620) in the area. The questionnaire used is similar to that now being used in the catchment area but lands were measured. The tables are complete and publication is expected shortly.

B. UNIVERSITY OF READING

Three reports concerning Botswana have been prepared by the Reading University, Department of Agricultural Economics. These are as follows:-

- Development Study No. 4 Agricultural Credit in Botswana
A. Harrison (1967)
- " " No. 5 Irrigation in Botswana
M. Upton (1969)
- " " No. 6 An Appraisal of Agricultural
Extension in Botswana
M.G. Lever (1970)

In addition, I.B. Gardiner made an evaluation of small dams in 1968 but did not publish a formal report. Gardiner is at present following up this work by further investigation in the field.

Upton collected data from a number of sources on irrigation costs and prepared linear programmes for both irrigated and dry land farms using Mogobane data as the main basis for the former and data from the Sedibeng unit farms for the latter.

As part of his study, Lever, in conjunction with G.F. Jackson of the Ministry of Agriculture, conducted a farm management survey in the 1967/68 season involving alternate day recording on a sample of 112 holdings in the South East of the country divided between pupil and non pupil farms. He does not appear to have used all the material that should be available from the survey in his report and it is possible that further data could usefully be extracted from the original records which are now available at Lobatse. This possibility should be investigated.