PUBLIC ADMINISTRATION AND DEVELOPMENT, Vol. 2, 265–272 (1982)

Rapid Labour Data Collection for Secondary Crops: Cocoyam and Soybean Farming Systems in Nigeria[1]

HENDRIK C. KNIPSCHEER
Winrock International

SUMMARY

The challenge to effective farming systems research is to find methods of system appraisal that maximize the use of existing information and are timely while maintaining a certain measure of accuracy and validity—in other words to achieve rapid rural appraisal. The comparative method for the collection of labour utilization for secondary crops is based on a combination of literature study and field survey. Farmers compare foodcrops of which labour utilization data are known with crops of which the labour requirements are unknown. From the rankings, the labour use of the unknown crops can be derived.

The comparative method was applied for cocoyam and soybean farming systems in Nigeria. In both cases absolute labour data derived correspond with relative labour data provided by the farmers themselves. The method, therefore, seems to be a quick, but nevertheless reliable, method by which generally applicable labour utilization data can be obtained.

INTRODUCTION

Decision makers in rural development and agricultural research need to know the main parameters of existing farming systems. The information gathering must be as accurate as possible and, above all, timely to be of any use. Moreover, the data collection needs to be cost efficient. Chambers (1981) has eloquently argued that the most cost-effective method of data collection is to be found in the middle zone between 'quick-and-dirty' and 'long-and-dirty'. Long time lags between data collection and reporting make the latter method always expensive, and often also operationally useless, therefore 'dirty'.

The great challenge to effective farming systems research is to find methods of systems appraisal that maximize the use of existing information, while maintaining a certain measure of accuracy. This article highlights a new method for the rapid appraisal of the farming systems component most difficult to assess, the labour utilization. The method developed provides indications for the validity as well as accuracy of the estimates. Using cocoyam and soybean farming systems in Nigeria as examples, labour utilization figures for these crops are quantified for the first time.

[1]An earlier version of this paper was presented at the annual meetings of the American Agricultural Economists Association in Clemson, South Carolina, U.S.A., July 1981.

Dr. Hendrik Knipscheer was previously agricultural economist at the International Institute of Tropical Agriculture, Ibadan, Nigeria and is presently farming systems economist for Winrock International at the National Institute for Animal Production in Bogor, Indonesia.

0271–2075/82/030265–08$01.00
© 1982 by John Wiley & Sons, Ltd.

THE PROBLEM

One of the most difficult farming systems components to measure is labour utilization. For most parts of tropical Africa, labour is still the main input for food farming systems (Ruthenberg, 1976). Although good quality land is scarce, land in general is still available, and it is the availability of labour, more than even that of cash money, that is felt by the farmers as their main constraint.

One of the major areas of concern in the analysis of African farming systems, therefore, lies in the description of the labour input, labour calendar and cultivation practices. Of these three elements, the latter two (labour calendar and cultivation practices) are relatively easy to describe, as one-visit surveys are largely adequate to obtain a reasonable impression about these aspects of the farming systems. Labour input data are much more difficult to obtain, in particular on a crop per hectare basis. Crop production figures in tropical countries are scarce mainly because of the irregular size of the farmer's fields. For both the farmer and the surveyor the ill-determined limits of the fields make conversion of labour input data into labour utilization data per hectare difficult. The problem is compounded by the general practices of intercropping and fallow periods.

The obvious method to overcome the problem of unknown and irregular field sizes is the actual measurement of field area. The irregular polygon calculation, based on the principle of triangulation—division of the surface into a complex of triangles—is one such method (Hoyoux, 1979). However, even this method, although fast, becomes costly if one seeks to overcome any problems of location specificity by covering a large geographic area with numerous samples. The labour input/ha measurement become even more expensive if one also aims to deal with the problem of time specificity. In any particular year the weather or pest conditions might be particularly favourable or unfavourable for certain crops. Accurate estimates, therefore, should be based on a series of measurements over time as well as over space.

The problem of collection of labour utilization data for secondary crops is, in particular, striking. Secondary crops are crops that, although generally grown, do not belong to the main food staples of a country. Cocoyam, sesame seed, plantain and soybean are examples of secondary crops in Nigeria. Faced with the cost of data collection, the researcher limits the observations to principal foodcrops such as yam, cassava, maize, cowpea, groundnut, sorghum and millet. Consequently, the literature presently shows a fair amount of labour input data for these crops, but none, whatsoever, for the secondary crops.

The key question, therefore, is how to obtain rapidly and at minimum costs reliable labour utilization data for secondary crops, which are preferably not time and location specific.

THE COMPARATIVE METHOD

At the International Institute of Tropical Agriculture (IITA) the socio-economic unit has successfully developed a low cost and rapid method to derive labour utilization data for secondary crops. The method is based on a combination of desk study and field survey.

During the desk study, labour utilization data for the principal crops are collected from available surveys that have been conducted during the last ten years in the same ecological area—i.e. West Africa. From these sources, labour utilization data per operation (land-preparation, planting, fertilizer application, weeding and harvesting) are derived. These are general, non-time and non-location specific estimates. The compilation of labour data from different sources should be done with caution but is generally possible (Connell and Lipton, 1977). The unit of measurement is man-days/ha. In cases that sources provide labour data in man-hours/ha, these are converted into man-days (6 man-hours = 1 man-day). During the growing season(s) of the foodcrops the demand for labour is high and the average farmer works 5–7 hours per day (Cleave, 1974).

A one-visit survey is then conducted in numerous villages over a large area. As past surveys have indicated, the variability in cropping methods among groups of farmers in different villages is generally larger than the variability among individual farmers within the same village. For that reason, a limited number of farmers per village are interviewed (for example 6–10) whereas the number of villages surveyed is relatively high (for example 10–20) and well dispersed over the area of investigation. The farmers are asked to compare the labour utilization for the secondary crop with those for two principal crops (of which the data are known from the literature), assuming a plot of equal size for each of the crops.

Each farmer ranks the one secondary crop and the two principal crops according to their labour requirements. From these ranking the percentages of farmers that consider the labour requirements for the secondary crop more and less than that of each of the principal crops are derived. These percentages are now assumed to reflect the *probability* that the labour requirements of the secondary crop are higher or lower than those of one of the principle crops. A second basic assumption is that the estimates of the farmers follow a normal distribution with an unknown mean (μ) and an unknown variance (σ^2). Figure 1 shows the hypothetical distribution of farmers according to their rankings of labour requirements.

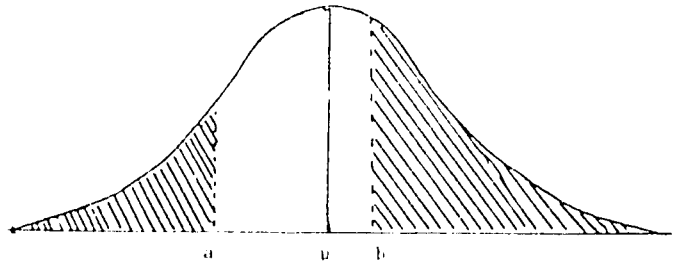

Figure 1. Frequency distribution of surveyed farmers according to labour input requirements ($y \sim N\{\mu, \sigma^2\}$)

The shaded parts in Figure 1 are the percentages of farmers that consider the labour requirements of the secondary crop (y) lower than that of crop A (expected value = a), and higher than that of crop B (expected value = b). The values a and b are derived from the literature study. The assumption of normal distribution allows the use of the Z-statistics where Z is the standardized normal random variable:

$$Z_1 = \frac{y_1 - \mu}{\sigma}$$

which is associated with the probability:

$$P(y_1 < y < \mu) = 0{\cdot}5 - P(y < y_1)$$

In Figure 1, $Z_A = (\mu - a)/\sigma$ where Z_A is associated with the probability of farmers judging the labour requirements of the secondary crop lower than that of crop A. From the percentage of farmers ranking the labour input of crop y lower than that of crop A, this probability can be estimated. This probability, in turn, provides the associated value for Z_A. Analogously, the value of $Z_B = (b - \mu)/\sigma$ can be derived.

The point of the analysis is that it can be shown that:

$$\mu = \frac{Z_A(b) + Z_B(a)}{Z_A + Z_B}$$

In this equation the unknown σ has cancelled out.

The estimation of μ per operation provides absolute figures on the labour requirements of the secondary crop. From this absolute figure (man-days per hectare), the relative importance of the labour requirements per operation can be derived. These relative values, in turn, should be compared with the relative values that are found elsewhere in the field survey, when farmers are asked to estimate the number of days they actually worked on their secondary crop. As the plot size is unknown, only *relative* labour utilization per operation can be derived from these answers. The comparison of the absolute and the relative figures provides us with a validity norm of this comparative approach.

COCOYAMS

Cocoyam is a root crop, generally grown in the forest zone of the humid tropics. It has a higher nutritional value than cassava, but is thought to be more labour intensive. Although labelled by the National Academy of Sciences (1975), as a 'crop with promising economic value', very little is actually known about its production economics.

Nigeria, with 40 per cent of the world production (Onwueme, 1978), is the main producer of this crop. In 1980, a farming systems survey was conducted among 66 farmers in 10 villages spread out through East and West Nigeria in cocoyam producing areas. During this survey, the comparative method was first used.

Maize and cassava were selected as benchmark crops. Both staple foods are extensively documented. Based on surveys and estimates by Jones (1959), Parker (1973), Thornton (1973), Igwebuike (1975), Idowu (1975), Phillips (1976), IITA, the World Bank and other sources[2] labour utilization data for the forest zone could be derived (Table 1).

[2]A preliminary compilation of these data was done by Knipscheer (1980).

Table 1. Results—comparative method cocoyam labour utilization data

Operation	Benchmark crops		Probability distribution of cocoyam labour requirements		Standardized normal random variable		Cocoyam labour utilization		
	maize (a)†	cassava (b)†	$P(a < y < \mu)$	$P(b > y > \mu)$	Z_a	Z_b	man-days/ha μ	% (1)	% (2)
Land preparation	24	40	0.348	0.136	1.03	0.35	36		
Planting	10	13	0.439	−0.106	1.54	−0.27	14	33.8	31.4
Weeding*	25	45	0.076	0.045	0.19	0.11	38	25.7	27.2
Harvesting	16	70	0.242	0.061	0.65	0.15	60	40.5	41.4
Total	75	168					148	100.0	100.0

(1) Derived by the comparative method.
(2) Direct from questionnaire responses.
*Generally two weedings for cocoyam.
†Man-days/ha.

Table 2. Results comparative method soybean labour utilization data

Operation	Benchmark crops		Probability distribution of soybean labour requirements		Standardized normal random variable		Soybean labour utilization		
	sorghum (a)†	groundnut (b)†	$P(a < y < \mu)$	$P(b > y > \mu)$	Z_a	Z_b	man-days/ha μ	(1) %	(2) %
Planting*	10	16	0.364	0.091	1.10	0.23	15	19.2	22.1
Weeding	20	29	0.424	0.045	1.43	0.11	28	35.9	30.9
Harvesting	16	40	0.333	0.106	0.97	0.27	35	44.9	47.0
Total	46	85					78‡	100.0‡	100.0‡

(1) Derived by the comparative method.
(2) Direct from questionnaire.
*Erroneously the land preparation activity was omitted in the questionnaire.
†Man-days/ha.
‡Actually the relative labour utilization for planting, weeding and harvesting amounted to only 65.3 per cent of the total labour input into soybean: additionally 25.3 per cent went for land clearing, 6.0 per cent for fertilizing, 9.5 per cent for insecticides application and 2.9 per cent for bird scaring (Table 3).

Table 3. Total labour utilization for soybean cultivation in Nigeria

Operation	Labour utilization	
	Percentage	Man-days
Planting, weeding, harvesting	65.3	78
Land preparation	25.3	30
Fertilizer application	6.0	7
Insecticide application	0.5	1
Bird scaring	2.9	3
Total labour	100.0	119

SOYBEANS

Soybeans were introduced in West Africa after World War II and gained popularity as a cash crop in the savanna region (Upper Volta and Central Nigeria). Because of the decline of the price level during the sixties on the world market, farmers lost interest in the crop. Now soybeans are mainly grown for home and local consumption. The use of locally grown soybeans for animal feed is uncommon. Nigeria is, with the modest production of 70,000 MT, by far the largest producer of soybeans in West Africa (FAO, 1978).

Sorghum and ground-nut were selected as benchmark crops. Of these two crops, sorghum and guinea corn is the best documented. Based on surveys and estimates by Norman (1972), Thornton (1973), Parker (1973), Normal *et al.* (1976), Hays and Raheja (1977), Williams (1980), by the World Bank and other sources, labour utilization data for the savanna zone could be derived (Table 2).

In case of soybean cultivation, the number of operations that were used for comparison with the benchmark crops were limited to those that were common for all three crops and of which the benchmark values could be estimated from literature sources with reasonable confidence. Actually, there are a number of other operations involved, most notably land preparation, fertilizer, insecticide application and bird scaring (the latter three not common among all farmers). From the estimated absolute and relative figures (65·3 per cent = 78 man-days) the labour utilization for these operations can be derived (Table 3).

CONCLUSION

In both cases, for cocoyam as well as for soybeans, the relative labour utilization per operation derived by the comparative method corresponds very well with the relative figures that are directly derived from the farmers responses to the question regarding their actual labour input. The latter figures support the results obtained by this new method.

It is even possible to calculate the variance (σ^2) that is associated with estimates of μ as an indication of the accuracy of the results. However, as the variation in

farmer's ranking of crops according to labour requirements depends on the differences in cultivation methods of the secondary crop as well as those of the benchmark crops, the interpretation of such a calculated variance would be difficult.

The comparative method, therefore, seems a quick but, nevertheless, reliable method by which generally applicable labour utilization data for secondary crops can be obtained.

REFERENCES

Chambers, Robert (1981). 'Rapid rural appraisal: rationale and repertoire', *Public Administration and Development* I. 95–106.

Cleave, J. H. (1974). *African Farmers Labor Use in the Development of Smallholder Agriculture*, Praeger, New York.

Connell, J. and Lipton, M. (1977). *Assessing Village Labor Situations in Developing Countries*, Oxford University Press, Delhi.

F.A.O. (1978). *1978 Production Yearbook*, Rome.

Hays, H. M. and Raheja, A. K. (1977). 'Economics of sole crop cowpea production in Nigeria at the farmer's level using improved practices', *Samaru Research Bulletin* 286, Ahmadu Bello University, Zaria.

Hoyoux, J. M. (1979). 'A manual: measuring size of small farms', *Agricultural Economics Discussion Paper* 6/79, IITA, Ibadan.

Idowu, E. V. O. (1975). 'NAFPP benchmark studies for maize and rice', *Mimeo*, NAFPP, Ibadan.

Igwebuike, R. U. (1975). 'Barriers to agricultural development: a study of the economics of agriculture in the Abakaliki area, Nigeria', *unpublished Ph.D. Thesis*, Stanford University.

IITA (1976). *Annual Report 1976*, Ibadan, Nigeria.

Jones, W. O. (1959). *Manioc in Africa*, Standford University Press, Stanford University.

Knipscheer, H. C. (1980). 'Labour utilization data for selected tropical food crops', *Agricultural Economics Information Bulletin No. 6/80*, IITA, Ibadan.

National Academy of Sciences. (1975). *Underexploited Tropical Plants with Promising Economic Value*, Washington, D.C.

Onwueme, I. C. (1978). *The Tropical Tuber Crops*, Wiley, New York.

Norman, D. W. (1972). 'An economic study of three villages in Zaria province: 2. Input–output study (text)', *Samaru Miscellaneous Paper No. 32*, Ahmadu Bello University, Zaria.

Norman, D. W., Fine, J. C., Goddard, A. D., Kroeker, W. J. and Pryor, D. M. (1976). 'A socio-economic survey of three villages in the Sokoto close-settled zone', *Samaru Miscellaneous Paper No. 64*, Ahmadu Bello University, Zaria.

Parker, R. N. (1973). 'The feasibility of some small-scale development projects in the light of a community's socio-economic structure', *unpublished M.Sc. Thesis*, University of Reading.

Phillips, T. A. (1976). *An Agricultural Notebook*, Longman, Ibadan.

Ruthenberg, H. (1976). *Farming Systems in the Tropics*, Clarendon Press, Oxford.

Thornton, D. S. (1973) 'Agriculture in South East Ghana', *Development Study No. 12*, University of Reading.

Williams, L. B. (1980). 'Benchmark survey for sorghum' in Knipscheer, H. C., Menz, K. M. and Khadr, F. H. (eds.) *Benchmark Surveys of Three Crops in Nigeria: Wheat, Millet and Sorghum*, IITA/NAFPP, Ibadan.