# PRESENT AND POTENTIAL LABOUR USE IN CASSAVA PRODUCTION IN COLOMBIA

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## SUMMARY

Present labour use in cassava production in Colombia was estimated at about 60,000 man-years, or 2.4 percent of the total agricultural labour force. Weeding was the most labour-consuming activity. Potential labour use was analyzed as a function of increasing cassava area and of the adoption of mechanical, chemical and biological technology. Increases in cassava area at the present rate, with present methods, were estimated to require an additional 1,584 workers annually. Mechanization of land preparation and chemical weed control might reduce labour use by 2.5 man days/ha/year. Yield-increasing biological technology would be expected to increase labour demand among adopters slightly (1.8 man-days/ton/ha). However, if prices fall because of production expansions, the net impact on producer sector employment may be negative. The price flexibility for cassava for direct human consumption which could bring this about will no longer be a relevant criterion for estimating changes in employment if new markets, e.g. for livestock feeds, can be developed.

## RESUME

La main-d'ouvre actuelle utilisée pour la production du manioc en Colombie occupe environ 60,000 personnes annuellement soit 2.4 percent de la force totale de travail destinée à l'agriculture. Une part importance de cette force est consacrée aux travaux de désherbage. L'utilisation de la main-d'oeuvre potentielle est considerée comme un facteur d'accroissement des terres consacrées à la culture du manioc et de l'adoption des techniques de mécanisation, de l'emploi de produits chimiques et de l'application de la biologie. Si on considère le rythme actuel d'accroissement des terres consacrées à la culture du manioc et les méthodes de son exploitation, il faut 1,584 ouvriers supplémentaires par an pour satisfaire la demande en main-d'oeuvre. La mécanisation du labour et l'utilisation de produits chimiques pour lutter contre les adventices pourraient réduire la main d'oeuvre d'environ 2.5 ouvriers par hour et à l'hectare en un an. Les techniques de biologie pour l'accroissement du rendement pourrait légèrement augmenter la demande en main-d'oeuvre là où elles sont adoptées (1.8 d'ouvriers/jour/tonne/ha). Toutefois, s'il y a chute des prix en raison de l'extension de la production, l'impact sur l'emploi dans le secteur producteur peut être négatif. La flexibilité des prix du manioc directement consommé par l'homme qui peut en être la cause ne sera plus un facteur valable pour estimer les changements dans l'emploi si de nouveaux marchés, comme les aliments de bétail, peuvent être développés.

## RESUMEN

El uso actual de la fuerza de trabajo en la producción de yuca en Colombia se estimó en alrededor de 60,000 hombres-año, o 2.4% del total de la fuerza de trabajo agrícola. El deshierbe fué la actividad que consumió más mano de obra. El uso potencial de la fuerza de trabajo se analizó como una función del incremento del área destinada a yuca, y de la adopción de tecnología mecánica, química y biológica. Se estimó que el invremento del área para yuca en la producción actual, con los méthodos actuales, requiere de 1,584 trabajadores adicionales anualmente. La mecanización en la preparación de la tierra y el control químico de malas hierbas podrían reducir el uso de la mano de obra en unos 2.5 hombres/ha/año. Se podría esperar que le incremento de rendimiento por el empleo de tecnología incrementara ligeramente la demanda de fuerza de trabajo entre los que la adopten (1.8 hombres/día/ton/ha). Sin embargo, si los precios bajan debido a expansión de la producción, el impacto neto sobre el empleo, en el sector productivo, podría ser negativo. La variabilidad de los precios de yuca para consumo humano directo, que podría ocasionar aquella situación ya no constituiría un criterio relevante para estimar los cambios en cuanto empleo, si se pudiesen desarrollar nuevos mercados, pro ejemplo: el de alimento para ganado.


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## INTRODUCTION

High and increasing rates of unemployment, resulting in severe poverty among large segments of the population, is a common problem in most developing countries. The problem is generally associated with rapid population growth and inability of the economy to absorb the expanding labour force. A strong rural-to-urban migration trend accelerates urban unemployment. It is not uncommon to find urban areas with an annual population growth rate of 7–8 percent, with about half of this growth resulting from rural-to-urban migration, while the annual growth in urban employment opportunities may be only 3–4 percent.

Creation of more productive jobs at a greater rate than exists at present is essential to reduce poverty. Even to avoid worse poverty the rate of employment generation must be accelerated considerably.

Additional jobs may be created in the rural as well as the urban sector. More jobs in the rural sector tend to reduce rural-to-urban migration provided that earnings and working conditions in the rural sector are sufficient to satisfy the aspirations of the potential migrant. But, there have been few instances of rapid expansion of rural employment in recent years.

Governments of developing countries frequently consider a rapid reduction of the rural labour force necessary to accelerate economic growth. Furthermore, individual farmers tend to replace labour by machinery to increase labour efficiency and to reduce the problems associated with maintaining a large labour force. Farm machinery is frequently imported and hence domestic agricultural labour is replaced by foreign labour services, and the kind of mechanization adopted fails even to create additional jobs in local industry and commerce to absorb the displaced farm workers.

Recently, a number of developing countries have become concerned about the equity issues of economic growth. Equitable income distribution and possibilities for productive employment have been added to the goal of efficiency in establishing new social objectives in politics. In this new political trend, governments seek ways to increase employment in agriculture while gaining time to expand urban employment.

This paper deals only with a small fraction of the complex problems of employment in agriculture. The paper attempts to analyze present and potential labour use in the production of cassava in Colombia. The specific objectives of the paper are:

1. To estimate present labour use in cassava production in Colombia.
2. To compare labour use in cassava production with that of other major agricultural products.
3. To estimate how certain new technology applied in cassava production may influence employment.

The analysis is limited to the production process. No attempt is made to estimate labour use in processing and marketing of cassava.

## THE EMPLOYMENT PROBLEM IN COLOMBIA

The total population of Colombia was estimated at 22.6 million for 1970. Twenty-nine percent of the population was considered economically active. Of the economically active, 2.5 million, or 38 percent were engaged in agriculture. Past population growth of 3.2 percent per year and massive rural-to-urban migration resulted in an urban population increase of 5.4 percent annually during 1951–64, while the rural population increased, in spite of migration to towns, at a rate of 1.3 percent. During the same period, the three largest cities grew at 7 percent per year[8]. New employment has been insufficient to meet the increase in the labour force, and unemployment is increasing.

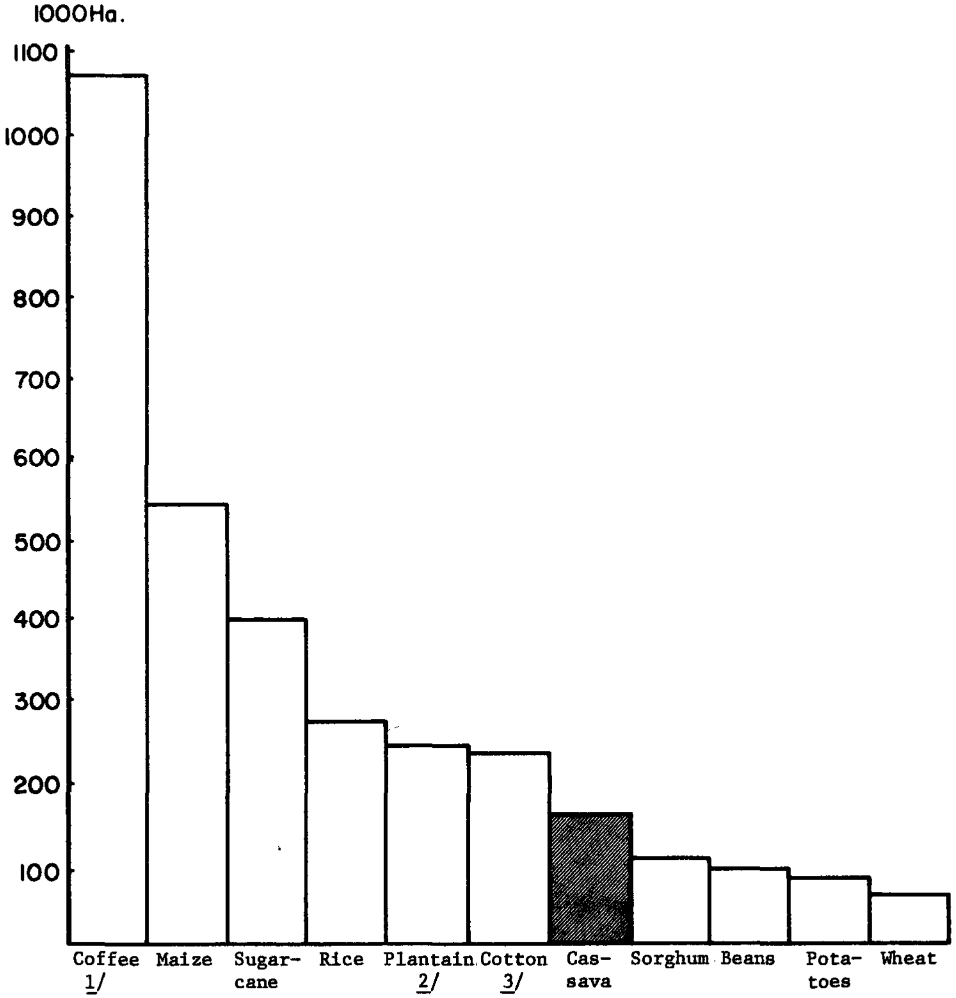
Despite the rapid outmigration, it is estimated that only 70 percent of the present potential agricultural labour force is employed. This figure takes into account unemployment as well as under-employment.

The Colombian labour force is projected to grow at a rate of 3.5 percent annually for a period of at least fifteen years, while employment during the last two decades rose only by 2.2 percent. It is estimated that agriculture will need to provide employment for 50,000 additional persons annually during the period 1970–85[8]. How can cassava production help meet this need?

## CASSAVA IN COLOMBIA

Although cassava occupies a considerable area in Colombia (Figures 1 and 2), the crop has received minimal attention from research workers and public agencies engaged in agricultural development. Yields are low, and little improvement has occurred in the last ten years (Figure 2). Production increases have resulted almost exclusively from expanded area. A linear trend shows an annual increase of 3,760 ha. (Figure 2).

Cassava, typically, is grown on small farms. As the producer and his family consume a considerable amount of the production, the amount going to market is considerably less than that produced. Because of the past lack of interest in the crop on the part of decision-makers in research and public policy, and because of its utilization as a subsistence crop, reliable statistical information on cassava is scarce. Hence the information presented in Figure 2 should be considered as a general indication rather than as an exact representation.



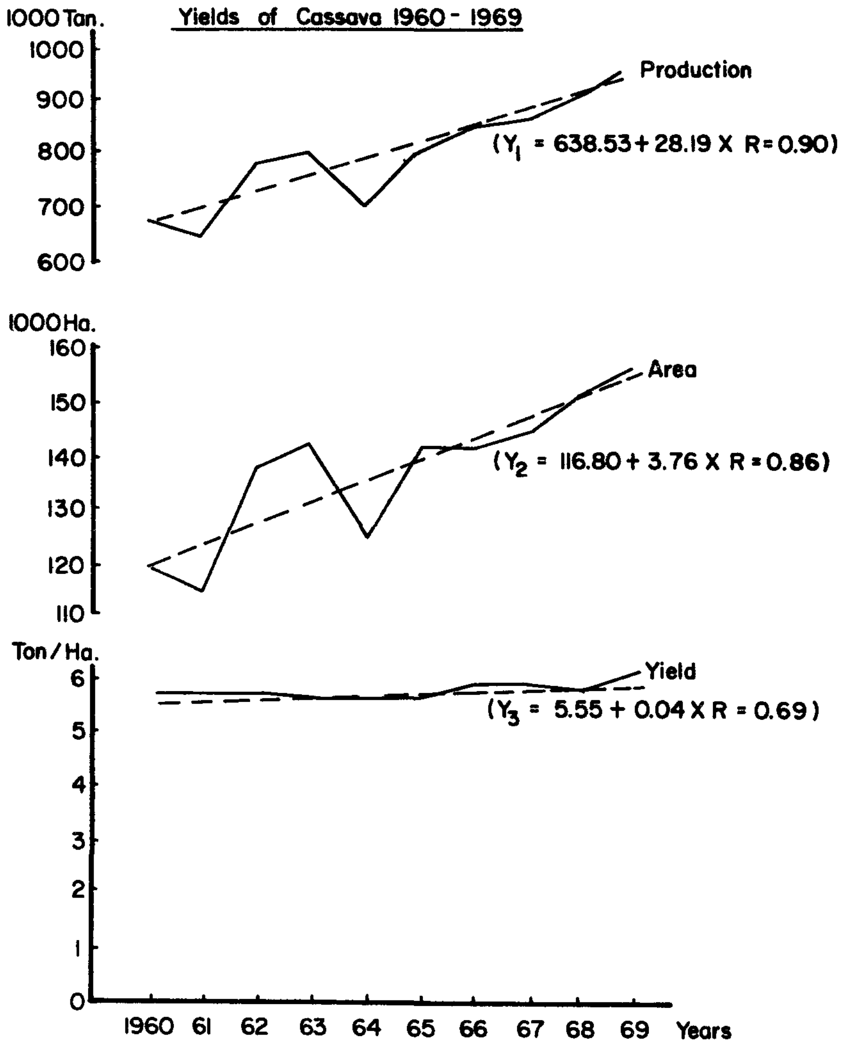

1/ Data from 1970

2/ Data from 1970

3/ Data from second semester of 1971 and first semester of 1972.

Source: Programas Agricolas del Ministerio de Agricultura. Oficina de Planeamiento del Sector Agropecuario, Bogotá, Colombia. January and December 1972.

Fig I. Area grown with II major crops in Colombia 1972 .




Sources: Programas Agricolas del Ministerio de Agricultura. Oficina de Planeamiento del Sector Agropecuario, Bogota, Colombia. December 1972. P. 204.

L. Jay Atkinson, Changes in Agricultural Production and Technology in Colombia. U.S. Department of Agricultural, Economic Research Service in Cooperation with the Ministry of Agriculture and The Central Planning Agency of Colombia. P. 25.

Fig 2 The trend in production, area and yields of Cassava 1960 - 1969.

To obtain more information on the cassava production process, data was collected from 300 producers in 19 departments of Colombia. Obtaining reliable information on production costs and the use of inputs was emphasized. This paper reports the major findings with respect to labour use.

About 30 percent of the sampled farms used machinery to prepare land. No other activities were mechanized. In order to assess the impact of mechanized land preparation on labour use and cost of production, the sample farms were classified in two groups according to whether land preparation was mechanized.

### Estimated labour use in cassava production

Table 1 shows the estimated labour use by production activity. Total annual labour use per hectare was estimated at 87.7 man-days using mechanized land preparation and 110.6 man-days when land was prepared manually. Weeding was the major labour-using activity. Manual land preparation and harvesting were other important labour activities.

To assess the general applicability of the results reported in Table 1, comparisons are made with results from similar studies undertaken in other regions. Total labour use per hectare in cassava production in the coffee zones of Colombia was estimated to be similar to that estimated for producers preparing land manually (Table 2), but the distribution of labour between production activities was quite different. In the coffee zone[2], more labour was spent on harvesting, but less on weeding. Estimates from North East Brazil[6] show a considerable variation between regions. However, the average labour requirements are similar to those estimated for Colombia. Labour requirements in the production of cassava in Jamaica[5] have been estimated to be considerably larger than those estimated for Colombia and Brazil.

The labour needed to produce a ton of cassava was estimated to be 7.5 man-days if machines were used for land preparation and 10.2 man-days if the land was prepared manually. Labour needs per ton of cassava produced appear to be similar for Colombia and North East Brazil while they are somewhat larger for Jamaica (Table 2).

Table 3 compares the labour use per hectare for 10 major crops in Colombia. Among the 10 crops, cassava occupies fifth place in terms of labour use per unit of land, being exceeded by sugar-cane, coffee, plantain and potatoes. Cassava provides about twice as many jobs as corn per unit of land per crop, and three times as many as wheat. In some regions, two crops of corn are grown per year, but only one of cassava, hence the labour use per year in these regions will be approximately the same for the two crops.

Assuming that the labour use per hectare reported in Table 3 is representative of the total national production, then the total annual labour use in cassava production is estimated to be approximately 2.4 percent of the total agricultural labour force. There will be some surprise with the finding that cassava uses more labour than cotton, since the latter is traditionally considered a major labour-consuming crop.

## POTENTIAL LABOUR USE BY DEVELOPING CASSAVA PRODUCTION

### Assumption of the analyses

On the future role of cassava production as a labour-absorbing activity, the analysis is divided into two parts. First, we will estimate the demand for labour as a function of the adoption of new technology, assuming constant cassava prices. Then we will remove this assumption so as to include the effect of product-market relationships (elasticities of supply and demand). Throughout the analysis, we assume an unlimited potential supply of labour, i.e. we assume that increasing demand for labour will have no impact on wages. This assumption appears valid for the relatively small demand changes to be dealt with in this analysis and in view of the present employment situation in Colombian agriculture, as previously discussed. (In regions with large seasonal fluctuations in labour demands for crops other than cassava, the assumption may not be valid during peak seasons. Labour demand in cassava production itself shows little seasonal variation.)

### Labour demand and new technology assuming constant cassava prices

Almost no technological change has occurred in cassava production in Colombia other than some mechanization of land preparation. Hence, the analysis attempts to predict changes in labour demand that might follow if new technology were to be adopted (*ex ante*) rather than to evaluate what has happened in the past (*ex post*).

Four levels of technological development are considered:

1. No new technology will be adopted. Area and yields will continue along past trends.
2. Mechanical technology will be adopted for land preparation. Area and yields will continue along past trends.
3. Chemical technology will be adopted for weed control. Area will continue along past trends but yields may increase.

4. Improved biological technology will be adopted. Area will continue along past trends, but yields will increase.

**No new technology.**

Past trends in cassava area show an annual increase of 3,760 ha. (Figure 2). Assuming constant factor and factor-product proportions, each additional hectare would require an additional 96 man-days per year (Table 3). Hence, taking 250 man-days as a man-year, the demand for labour would increase by 1,444 workers annually[7]. This amounts to 2.9 percent of the estimated additional needs for employment in agriculture (50,000 workers) as previously discussed. Present employment in cassava is only 2.4 percent of the total agricultural employment. Hence an expansion of the cassava area along past trends would provide more than its share of employment for the additional expected labour force. To the extent that the new cassava area originates from substitution to cassava from other crops, labour requirements for the production of other crops would however decrease. For example, substituting cassava for single-crop maize will increase labour demands for cassava by 96 man-days/ha. However, if two maize crops are, or can be, produced annually, the above substitution would reduce total labour use by 16 man-days/ha.

**Mechanical technology**

A large portion of the cassava area is found on slopes where mechanization would not be feasible. There is a considerable area though where mechanical means could replace present manual land preparation. Such replacement would displace (save) approximately 25 man-days per hectare (Table 1). Figure 3 shows the relationship between increasing mechanization of land preparation and the displacement of labour. We may speculate that about 10 percent of the total cassava area presently prepared manually is suitable for mechanical land preparation. A change from manual to mechanical means on this area would displace about 1,550 workers.

**Chemical technology**

Application of herbicides using a back-pack sprayer utilizes about three man-days per hectare. Hence, assuming an average labour use for manual weed control of 45 man-days/ha (Table 1), substitution of chemical for manual weed control would displace labour by about 42 man-days/ha. Figure 4 shows the relationship between the use of herbicides and labour displacement. If, for example, herbicides were used on 10 percent of the cassava area, labour employment would be reduced by 2,604 man-years. If used on one-half of the area, the labour displacement would be 13,020 or 21.7 percent of the total labour presently employed in cassava production.

Fig 3. The effect of mechanization of land preparation on labor use in cassava production in Colombia.

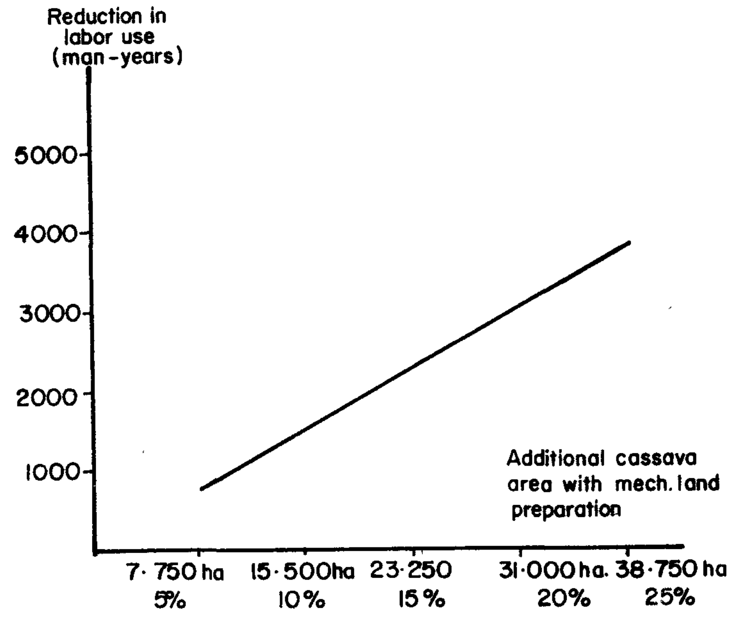
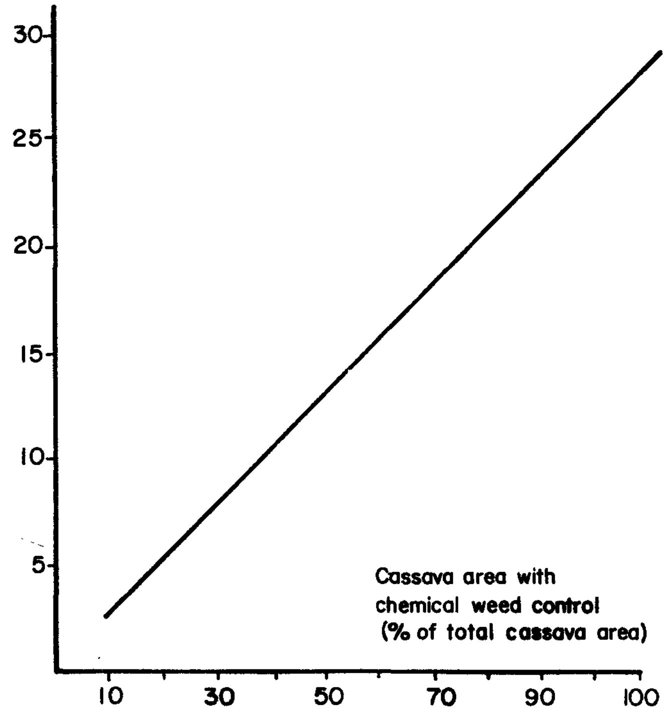



Fig 4. The effect of chemical weed control on labor use in cassava production in Colombia



Although application of herbicides might increase yields and thus increase labour needed for harvesting and packing, it is unlikely that a change from adequate manual weed control to chemical control would have an impact on yield. Present use of herbicides for cassava in Colombia is limited. However, an increase in the wage-herbicide price ratio could result in a considerable adoption of herbicide use.

**Biological technology**

Assuming that a new biological technology adopted by the farmers (high yielding cultivars, resistance to certain diseases etc.) results in increased yields, its impact on labour employment per unit of land will occur through increased harvesting and packing demand. If the adoption of new cultivars must be accompanied by increased fertilizer use or other improved cultural practices, then labour requirements for these activities may increase as well. But insect-resistant cultivars may reduce labour employment for insecticide application. This analysis is limited to the impact on labour for harvesting and packing. Changes in labour for other activities would probably be relatively small and would depend on the specific characteristics of the biological technology. They cannot be estimated in this general analysis.

Labour requirements for harvesting and packing as a function of yield were estimated for the farmers included in the sample previously mentioned using simple linear regressions. The results were as follows:

$L = 5.7214 + 1.8066Y,\ R^2 = 0.7352$

Where L = labour requirement for harvesting and packing (man-days/ha.). Y = yield (tons/ha).
i.e. Each unit increase in yield (ton/ha) requires an additional 1.81 man-days/ha. for harvesting and packing.*

Based on this estimate, we then proceeded to estimate the change in labour requirements as a function of the level of yield increase among adopters of new biological technology and adoption rates.The following equation was developed:

$$\Delta L = \frac{(\%\Delta Ya)}{100} \times (\%Aa) \times \frac{Yn}{100} \times \frac{(b)}{k} \times An$$

where:

| | | |
|---|---|---|
| $\Delta L$ | = | change in total labour requirements (man-years) |
| $(\%\Delta Ya)$ | = | percentage change in yields on farms adopting new technology** |
| $(\%Aa)$ | = | percentage of total cassava area where new technology was adopted |
| $Yn$ | = | average national yields before adoption (ton/ha) |
| $b$ | = | coefficient of the above regression equation |
| $An$ | = | total cassava area (ha) |
| $K$ | = | number of work days per year (assumed to be 250) |

By substituting 1969 average national yields and cassava area for Yn and An and using the estimated values of the b coefficient, the equation becomes:

$$\Delta L = 0.6747\ (\%\Delta Ya)\ (\%Aa)$$

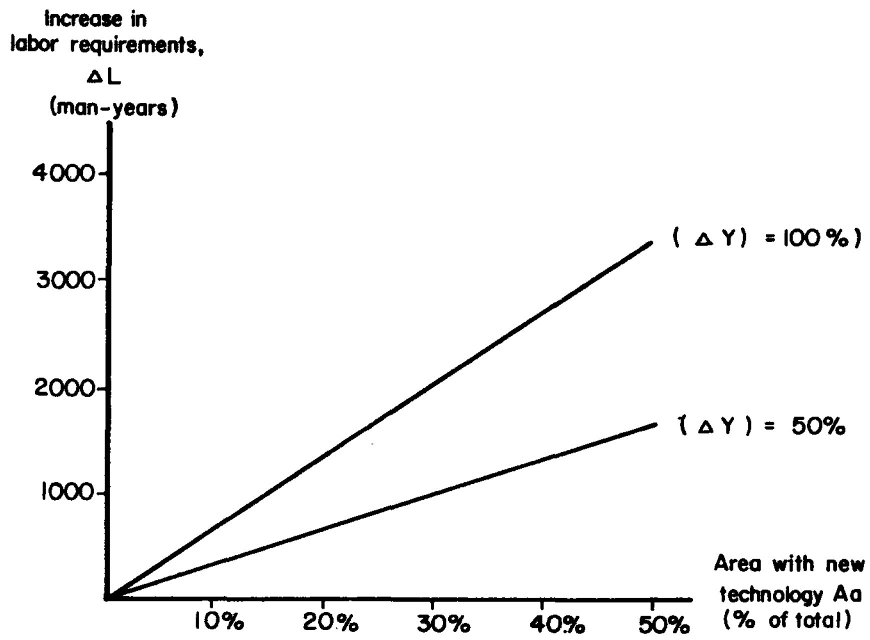
The impact of the adoption of new biological technology on labour requirements can be estimated directly from the equation on the basis of yield increasing effects and rate adoption. Figure 5 shows the relationship between rate of adoption and labour requirements for selected levels of yield increases. If, for example, the adoption of a certain new biological technology increases yields on adopting farms by 100 percent and the technology is being adopted on 10 percent of the cassava area, the estimated increase in labour requirements is 675 man=years. If the technology is adopted on 50 percent of the area, labour requirements increase by 3.374 man-years.

A certain increase in labour absorption may be brought about by a number of combinations of yield increases ($\Delta Y$) and adoption rates (Aa). Figure 6 shows this relationship for selected levels of labour absorption. As an illustration of the use of the curves presented in Figure 6, assume that the desired level of increase in employment in cassava production is 1,000 man-years. This level may be reached by any combination of yield increase and adoption rate shown by the curve labelled L = 1000 man-years, for example, a yield increase of 100 percent on 15 percent of the area.

* The elasticity of employment, defined as the percentage change in labour requirements for each one percent change in cassava yields, was estimated to be 0.2. This implies that total labour requirements per hectare increase by 0.2 percent for each one percent increase in yields/ha.

**Percentage change based on national average yields not individual farm yield.

Fig 5. The effect of adoption of new biological technology on labor requirements.




**Labour demand and new technology considering market impact**

In the previous section we estimated the impact of new technology on labour demand assuming constant cassava prices. How realistic is this assumption? As yield-increasing technology is adopted and area is expanded, more cassava will be produced. If the increase in the quantity produced exceeds the increase in the quantity demanded at the current price, a downward pressure on the price will result.

The demand for cassava in Colombia is projected to increase by about 36 percent, at constant prices, during the period 1970–80.[4] If past area and yield trends continue, production will increase by 31 percent (estimated from regression equations shown in Figure 2). Hence, national yields can increase five percent more than indicated by past trends, or a total of 11.5 percent, during the period without a price-depressing effect. In this case, labour demands will increase by 1.443 man-years annually because of area expansions and 138 man-years annually because of yield increases*, or a total of 1.581 man-years annually.

The price decrease likely to result from supply expansion beyond those estimated above can be estimated from the price elasticity of demand.** The majority of the cassava grown in Colombia is directly consumed by people. The price elasticity for cassava for direct human consumption is such that supply expansions beyond normal demand increases will result in price declines proportionally larger than the supply expansions. Thus total revenues to the producer sector will decrease as production increases. This analysis would imply that traditional resources (land and labour) must move out of cassava production as new technology is adopted. If the cassava producers were to depend exclusively on the demand for direct human consumption, supply expansions beyond those needed to fulfill demand increases at current prices would result in a reduction in labour demand. While the farmers adopting the new technology would expand labour demands, at least initially, the expansion would be insufficient to counteract the reduction in labour demands among non-adopting farmers, a proportion of whom would not be able to recover costs at the lower prices. The adopters, however, can stand a considerable price fall. The additional production brought about by the new technology adds little to total costs per hectare*, but the cost per ton is severely reduced.

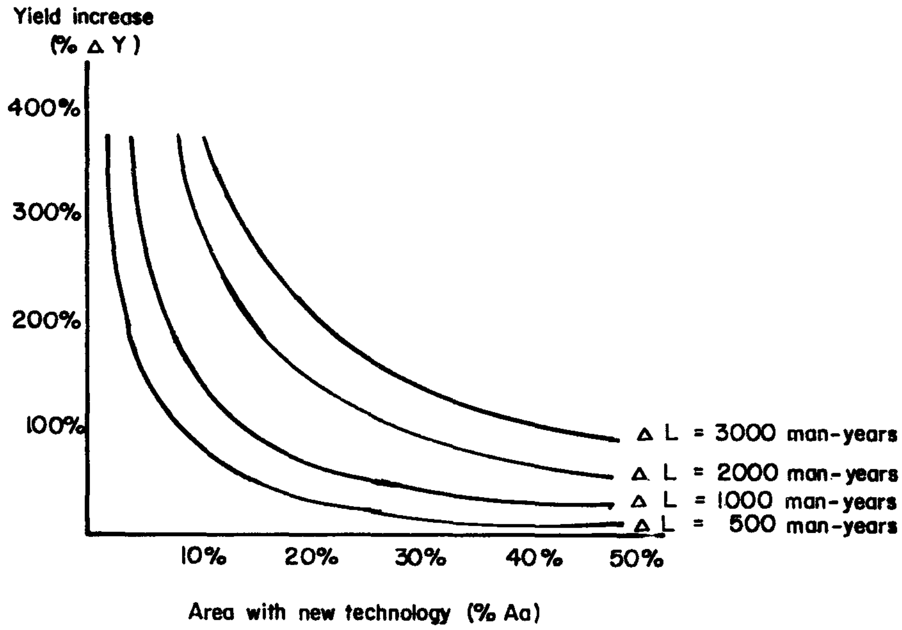
There are a number of reasons why cassava prices may not fall as drastically as indicated above as envisaged for large production expansions. The government may, for example, establish support prices to protect the producer. Furthermore, if prices are allowed to fall, new markets, such as cassava for livestock feed, should appear. This will slow down the rate of price decrease. The price elasticity for the direct human consumption market would thus no longer be a valid criterion for estimating changes in labour employment. Further production expansions may well increase returns to the producer sector and also allow for a net increase in labour demands.

* The elasticity of employment (0.2) multiplied by the percentage increase in yields (11.5) provides an estimate for the increase in employment between 1970 and 1980 (1.380). Assuming a linear increase in yields during the period, the annual increase in labour demand will be 138 man-years.

**The price elasticity of demand is defined as the percentage change in the price of a commodity for each one percent change in the supply of the commodity in order that the market may be cleared.

*Each additional ton/ha. is expected to add the cost of 1.8 man-day, while the average current labour use, was estimated at 9.6 man-days/ton.

Fig 6. Alternative combinations of yield increase and adoption rate resulting in selected levels of increase in labor requirements.




## CONCLUSIONS

By examining the present and potential labour absorption in cassava production in Colombia we have estimated present labour employment at about 60,000 man-years, or 2.4 percent of the total agricultural labour force. Weeding accounts for 40–50 percent of the total labour requirements, being the most labour-consuming activity in cassava production, followed by harvesting and packing.

If past trends continue, additional cassava production will require an annual increase of 1,581 workers or 3.2 percent of the expected annual increase in the agricultural labour force. Mechanized land preparation and chemical weed control reduce labour requirements per hectare by about 22 and 40–50 percent respectively. Extensive mechanization and/or herbicide use could have a significant negative impact on labour demand.

While new biological technology is expected to increase labour demand among adopters, the increase is relatively small (1.8 man-day/additional ton produced) and may well be offset by labour reductions among non-adopters if cassava prices are permitted to adjust to large supply expansions resulting from the new technology. The marginal cost associated with adoption of yield increasing biological technology is extremely low. The adopters will be able to absorb a considerable price fall and still maintain a reasonable net return. As prices fall, the non-adopters will find their net returns reduced, and losses may occur. This will result in a reduction in labour and land dedicated to cassava among non-adopters. New uses for cassava, such as livestock feed and industrial processing, are likely to become economically sound as prices fall. When this occurs, the price may stabilize as production expands. This would result in increased revenues to the producer and allow for additional employment.

Based on this study, we conclude the following:

1. Cassava production contributes significantly to agricultural employment in Colombia.
2. Increasing the cassava area and yields along past trends to meet increasing demand may be expected to employ a considerable number of agricultural workers.
3. Adoption of yield-expanding biological technology will be neutral if cassava prices remain constant, and negative if prices fall.
4. The impact on labour demand among non-adopters will be neutral if cassava prices remain constant, and negative if prices fall.
5. The net effect of yield-increasing biological technology on labour use in the producer sector could be positive, neutral or negative, depending on the extent to which cassava prices decrease.
6. As the cassava production is expanded and prices decrease, production of new markets for cassava are likely to be economically feasible. Prices will not fall in these markets to the extent indicated by the price elasticity of demand for direct human consumption.
7. Extensive mechanization of land preparation and/or extensive use of herbicides would have a considerable adverse impact on employment.
8. The social objective of creating employment may conflict with private objectives of maximizing profits.

It is clear from this analysis that while biological research may have a considerable positive impact on productivity and hence increase consumer real income through reduced food prices and/or increase producer real income through higher net returns, it may at the same time have an adverse impact on employment. Furthermore, while increasing mechanization and chemical weed control may increase net returns to the producer, the impact on the social objective of expanding employment will be negative. The extent to which labour will be replaced by mechanical and chemical technology depends, at least in part, on the relative factor prices, which in turn may be influenced by public policy. It is important that these trade-offs among goals be fully understood by government policy makers so that corrective measures may be introduced, if needed to meet overall development objectives.

## REFERENCES


1. Daines, S.R. *et al.* (1972) Summary results of employment, income distribution and small farm analysis. Analytical working document No. 2, Colombia Agriculture Sector Analysis, AID, Bogota.

2. Fondo de Desarrollo y Diversificación de Zonas Cafeteras, (1968) Cultivos y empresas de sustitución para zonas cafeteras margeinales.

3. Ministerio de Agricultural, Programas Agricolas. (1972) Oficina de planeamiento del sector agropecuario.

4. Phillips, T.P. (1973) Cassava: a study of utilization and potential markets. School of Agricultural Economics and Extension Education, University of Guelph, Canada. (Preliminary report.)

5. Rankine, L.B. & Houng, M.H. (1971) A preliminary view of cassava production in Jamaica. Occasional Series No. 6. Department of Agricultural Economics, University of the West Indies, Trinidad.

6. University of Georgia, (1971) Feasibility of manioc production in Northeast Brazil.

7. U.S. Department of Agriculture, Economic Research Service in cooperation with the Ministry of Agriculture and the Central Planning Agency of Colombia. Changes in agricultural production and technology in Colombia.

8. World Bank Country Economic Report (1972) *Economic Growth of Colombia. Problems and Prospects.* Johns Hopkins University Press, Baltimore.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### TABLE 1

Estimated labour use in the production of cassava in Colombia by activity

| Activity | Mechanical land preparation | | Manual land preparation | |
|---|---|---|---|---|
| | Man-days per ha/yr | % | Man-days per ha/yr | % |
| Land preparation | - | - | 25.0 | 22.6 |
| Planting | 9.1 | 10.4 | 10.8 | 9.8 |
| Re-planting | 0.3 | 0.3 | 0.6 | 0.6 |
| Weeding | 46.8 | 53.4 | 43.2 | 39.0 |
| Fertilizer application | 0.5 | 0.6 | 0.3 | 0.3 |
| Insecticide application | 0.3 | 0.3 | 0.7 | 0.6 |
| Harvesting and packing | 30.7 | 35.0 | 30.0 | 27.1 |
| TOTAL | 87.7 | 100.0 | 110.6 | 100.0 |

## TABLE 2

**Labour use per hectare and per ton of cassava produced in Colombia, Brazil and Jamaica**

| | Man-days per ha/yr | Yield (ton/ha) | Man-days per ton |
|---|---|---|---|
| Colombia[1*] | | | |
| Mechanized land preparation | 87.7 | 11.7 | 7.5 |
| Manual land preparation | 110.6 | 10.8 | 10.2 |
| Colombia[2*] | | | |
| Coffee zones | 105.0 | - | - |
| Northeast Brazil[3*] | | | |
| Alagoas | 96.0 | 10.7 | 9.0 |
| Maranhao | 69.0 | 10.0 | 6.9 |
| Sergipe | 165.4 | 13.9 | 11.9 |
| Average | 110.0 | 11.5 | 9.6 |
| Jamaica[4*] | | | |
| Mandeville | 191.5 | 15.9 | 12.0 |
| Santa Cruz | 186.0 | 6.3 | 29.5 |

1* Data estimated in this study

2* From: Fondo de Desarrollo y Diversificacion de Zonas Cafeteras. Cultivos y Empresas de Sustitucion para Zonas Cafeteras Marginales, 1968.

3* From: Feasibility of Manioc Production in Northeast Brazil. University of Georgia, 1971, p.45.

4* From: Rankine, L.B. & Houng, M.H. A Preliminary View of Cassava Production in Jamaica. Occasional Series No.6. Department of Agricultural Economics, University of West Indies, Trinidad. December, 1971.

## TABLE 3

**Estimated labour absorption in the production of various crops in Colombia**

| Crop | Area (1,000ha) | Labour use per ha/yr (man-days)* | Total labour absorption: Man-years (1,000)** | Total labour absorption: Percent of total agr. labour for. *** |
|---|---|---|---|---|
| Coffee | 1,069 | 134 | 572.8 | 22.9 |
| Sugarcane | 398 | 145 | 230.8 | 9.2 |
| Corn | 542 | 56 | 121.6 | 4.9 |
| Plantain (cooking bananas) | 240 | 120 | 115.2 | 4.6 |
| Rice | 273 | 68 | 74.4 | 3.0 |
| Cassava | 155 | 96 | 59.6 | 2.4 |
| Cotton | 238 | 62 | 59.2 | 2.4 |
| Potatoes | 80 | 115 | 36.8 | 1.5 |
| Beans | 92 | 68 | 25.2 | 1.0 |
| Sorghum | 104 | 15 | 6.4 | 0.3 |
| Wheat | 61 | 31 | 7.6 | 0.3 |

* Daines, S.R. et al. Summary results of employment, income distribution and small farm analysis. Analytical Working Document No.2, Colombia Agriculture Sector Analysis, AID, Bogota, 1972.

** Assuming that a man-year is equal to 250 man-days.

*** Total agricultural labour force in Colombia 970 was estimated to be approximately 2.5 million (Ecomomic Growth of Colombia, Problems and Prospects, World Bank Country Economic Report, Washington, 1972.)