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LABOUR-RELATED STRUCTU
MERCIAL GRAIN PRODUCT
SUMMER AND WINTER RAINF

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Abstract

Data from the end of the second World War (1945) to the 1 of farming with regard to labour. Where possible explan economic problem with regard to farm labour. Two struct summer rainfall areas. The period 1945-1970 witnessed a draught oxen. Larger areas could be managed and more lab troduction of the combine harvester alleviated this problem capital, giving rise to some of the socio-economic concerns e the expansion in cultivated area took place before 1945. Th of labour for machinery, especially in the period 1945-1970. trailed that in the winter rainfall area.

Uittreksel

Data vanaf die einde van die tweede Wêreldoorlog (1945) t struktuur van boerdery met betrekking tot arbeid te kwanti die oog op die identifikasie van die ekonomiese probleem r kommersiële mielieproduksie in die somerreënstreke is waa in bewerkte plaasoppervlakte, waarskynlik omdat trekkers was nodig. Die vraag na arbeid in die oesproses was groot dense is versterk deur beleide wat die koste van kapitaal ver in bewerkte oppervlakte voor 1945 plaasgevind. In die perio masjinerie plaasgevind, veral in die periode 1945-1970. Dit die winterreëngebied gevolg het.

1. Introduction

Changes in the ratio of the quantity of land, capital and lab used in agricultural production have played a fundamental r in the transformation of agriculture throughout the world the post-1945 era. The substitution of capital goods, includ new technology, for land and labour has played an especi important role in, for example, the USA (Schertz, 1979:24) has influenced the structure of farming there (Penn, 1979: The same is true for the commercial sector of South Afri agriculture (Biggs, 1982; De Klerk, 1983; Van Zyl *et al*, 1987

This paper is particularly concerned with the analysis of tre concerning farm labour in five major commercial grain prod ing areas of South Africa. Three of these are mainly ma producing regions, namely the North-Western Free St Western Transvaal and the Transvaal Highveld, while two mainly wheat producing areas, namely the Rûens and Swartl The data were obtained from production cost surveys done the Department of Agricultural Development on a rotat basis. Physical and financial data have in each survey been c lected for a random sample of approximately 80 farmers, e with more than 80 hectares maize or wheat.

2. Amount of labour and machinery used

The annual growth rate of a number of key variables involvi labour employment and related attributes are shown in Tabl for the periods involved in the analysis.

It appears that the number of employees per farm increas from 1945 to 1970 in all the areas. This is also true for period 1970-1987. The summer rainfall regions however sh insignificant trends in the period 1970-1987, while the win rainfall regions show marked increases in the number employees per farm.

The above trends have to be seen in light of the general crease in the total farm area and area under cultivation in the regions over all the periods under consideration. Culti tion as percentage of total farm area however differs betwe the winter and summer rainfall areas.

Table 1: Annual growth rate in the number of farm employ and real gross investment in machinery in commercial agric ture in the RSA for different periods, 1945-1987.

Period	Annual growth rate %	
	Total number of farm employees	Real gross investm in machinery
1945 - 1970	2.57	2.24
1970 - 1987	-1.15	2.75
1945 - 1987	1.20	2.38

Note: All values are significant at the 10 % level
Source: Calculated from Abstract (1990)

The summer rainfall areas show a general increase in the p centage area cultivated over all the periods while the win rainfall areas show a decrease.

This gives rise to two different phenomena in the summer a winter rainfall areas with regard to employees per 100 ha un cultivation. Employees per 1000 ha under cultivation creased significantly in the summer rainfall regions during period 1945-1970 while it remained fairly constant in the win rainfall areas over the same period. It however declined o the period 1970-1987 in all areas.

The decrease over the last period is partly explained by Klerk (1983). From a sample of farmers who started farm maize before 1968 in the Western Transvaal, De Klerk (19 obtained mechanization adoption rates as shown in Table He also reports percentages of roughly the same order farmers who started farming after 1968. These adoption ra show clearly that the majority of farmers in the Western Tra vaal have already changed to mechanized harvesting, and t process must have contributed to a decline in the quantity labour demanded, especially seasonal labour.

Table 3: Distribution (percentages of farmers) of harvest methods of maize in the Western Transvaal, 1968 - 1981

Year	Harvesting by hand	Mechanised harvesting	Hand a mechanis
1968	81	16	3
1973	54	38	8
1977	11	81	6
1981	5	89	6

Source: De Klerk (1983)

The mean annual growth rates in real investment in machin (total per hectare total farm area and per hectare under tivation) are shown in Table 4.

Cultivation as percentage of total farm area	Growth rate	1.62**	0.47	1.31**	1.83*	0.01	1.89*	1.72**	0.15	0.92*	-0.60	0.68	-0.04	-0.03	-0.56	-0.17
	R^2	80.0	13.3	90.1	79.1	0.1	59.4	81.6	8.6	70.6	78.1	25.9	1.3	0.18	21.5	15.3
Employees per 1000ha farm area	Growth rate	1.98**	-0.93*	-0.59	2.00**	-1.13*	0.38	0.40*	-0.73*	-0.14*	-0.48**	0.02	0.07**	-0.27*	-1.60**	-0.25
	R^2	81.6	26.9	29.3	81.8	37.3	36.8	25.7	36.4	61.8	99.8	0.2	75.8	19.1	91.9	27.7
Employees per 1000ha under cultivation	Growth rate	3.65**	-1.40*	-0.72	0.17*	-1.19*	-0.51*	0.11**	-0.88*	-1.06*	0.12	-0.65*	-0.26	0.30	-1.06*	-0.07
	R^2	27.9	66.3	75.4	31.5	18.5	75.8	44.4	27.9	76.1	10.5	39.3	45.3	8.26	45.1	1.52

**,Highly significant ($P<0.05$);*,significant ($P<0.10$);
R^2=Coefficient of determination.

Real investment in machinery per ha under cultivation	Growth rate	0.70*	2.56*	1.85*	1.11*	2.54*	1.79*	1.66*	2.19*	2.32*	1.26*	-0.23	1.08**	1.03*	-1.58	1.10**
	R^2	38.9	44.1	64.9	21.5	14.4	68.9	15.9	6.4	72.4	21.1	0.4	42.9	18.2	13.1	35.7
Investment in machinery as percentage of total investment	Growth rate	-1.78	1.3	-0.10	-2.64	-1.50	-0.98	0.08	-0.63	0.02	1.95**	-0.26	0.73**	3.39**	1.61	1.65**
	R^2	30.3	16.1	15.7	53.5	10.0	14.1	21.1	12.2	14.6	38.8	0.5	15.2	81.3	7.9	54.1

**,Highly significant ($P<0.05$);*,significant ($P<0.10$);
R^2=Coefficient of determination.

In kind remuneration per farm labourer	Growth rate	1.09	1.93	1.44	4.34*	1.04	-0.20	-0.046	0.64	1.35*	1.26*	-0.23	1.58**	1.03	-1.58	1.10**
	R^2	4.7	25.8	26.6	64.4	42.4	0.5	0.02	18.4	29.7	21.1	0.4	42.9	18.2	13.1	35.7
Cash remuneration as percentage of total remuneration	Growth rate	-0.74	2.88*	0.95*	-0.91	2.45*	0.31	1.20	3.14*	1.19**	1.95**	-0.26	0.73**	3.39**	1.61	1.65**
	R^2	6.6	33.5	22.9	36.8	32.1	15.9	27.1	51.2	52.0	38.8	0.5	15.2	81.29	7.9	54.1

**,Highly significant (P<0.05);*,significant (P<0.10);
R^2=Coefficient of determination.

Real total remuneration per farm labourer increased in all the areas over the period 1945-1970. It also increased in the summer rainfall region over the period 1970-1987, but decreased insignificantly in the winter rainfall region over the same period. The same trends hold for real cash remuneration.

Cash remuneration as percentage of total remuneration increased significantly over the period 1970-1987 in the summer rainfall region, but was insignificant over the period 1945-1970. The trend is however reversed in the winter rainfall area where cash remuneration as percentage of total remuneration increased significantly over the period 1945- 1970, but was insignificant over the period 1970-1987.

The above results coincide with these obtained by Fenyes (1983) and Antrobus (1984). It also shows that in kind remuneration will play a progressively smaller role over time both in the winter rainfall region (already since 1945) and summer rainfall region (since 1970).

4. Substitution of labour

In spite of an increasing trend in labour remuneration and total labour costs per farm unit over time, total labour costs constituted a declining proportion of total farm costs between 194 and 1987. Table 6 shows the percentage real increase in labour costs per farm unit per annum against that of total farm costs gross farm income, machinery costs and total direct and non direct allocatable costs per farm unit. Real changes in gross farm income are also shown.

Table 6 shows that real total costs, real direct and non-direct allocatable costs and real machinery costs increased over time in all the regions. Real labour costs increased from 1945-1970 in the summer rainfall areas, but decreased from 1970-1987. In the winter rainfall region real labour costs increased over both periods. Real gross farm income increased in the winter rainfall region over both the periods 1945-1970 and 1970-1987, but declined in the summer rainfall region. This is partly due to the difference between total farm output and maize production the drought that has been experienced in Southern Africa since 1980, and the inflation experienced since the 1970s with input prices rising faster than output prices (Louw, 1986; Van Zyl 1988a).

Using the Taiwanese and Japanese experience as examples Ishikawa (1981) suggested that the historical paths of change in per hectare labour input in rice production and the growth of yields may be represented by a curve with two distinct phases in the early phase labour intensity increases and it only declines in the later phase. Ishikawa (1978) has therefore distinguished two types of technological factors, apart from the natural and institutional factors, affecting labour absorption: (1) labour using technological factors e.g. higher yield varieties, application of fertilizer, and improved cultivation practices, all of which have yield-increasing properties at the same time; (2) labour-saving technological factors, mainly agricultural mechanization.

Utilizing the above-mentioned data it seems that the Ishikawa curve also holds for commercial maize production in the summer rainfall areas of South Africa. Before 1970 the effect of labour-using technology outweighed the effect of labour-saving technological factors with the result that labour utilization increased. After 1970 the opposite happened, resulting in a decrease of labour intensity with higher yields in maize production. On the other hand wheat production in the winter rainfall area only used the second type of technology over the period under consideration, namely labour-saving technology.

Labour cost as a percentage of gross farm income, total cost and machinery costs showed a negative annual growth rate over time in all cases. Table 7 depicts the situation.

Real DAC	Growth rate	7.17**	4.87*	7.16**	8.36**	4.31*	8.28**	7.68**	5.97*	7.89**	5.16**	7.40	5.93**	5.52**	4.02*	4.61**
	R^2	87.5	69.5	93.3	91.8	57.6	97.4	95.5	46.3	94.9	97.2	98.4	98.9	98.3	66.6	96.9
Real N-DAC	Growth rate	7.28**	2.69	5.76**	5.68**	2.11*	5.34**	5.62**	3.82*	6.02**	3.43**	5.83**	4.43**	4.09**	3.46*	3.94**
	R^2	84.6	33.2	91.4	99.6	48.8	99.5	88.6	63.8	96.1	99.5	90.2	98.1	94.9	75.7	97.4
Real machinery costs	Growth rate	10.01**	5.30**	6.39**	6.57**	2.73*	6.45**	7.66**	5.48*	7.82**	3.37**	7.18**	4.74**	4.26**	4.95**	4.50**
	R^2	59.1	39.2	83.1	98.2	45.9	99.4	81.4	70.0	94.8	99.2	96.4	97.7	91.9	84.1	97.5
Yield per hectare	Growth rate	1.01	1.24	2.54**	1.09*	-0.45	0.90	5.01**	0.14	2.17**	1.21*	3.41**	2.23**	1.96**	2.63*	1.90**
	R^2	2.3	11.4	28.6	22.1	8.8	0.02	61.7	8.6	25.2	21.7	52.4	65.2	49.22	23.96	56.8

**,Highly significant ($P<0.05$);*,significant ($P<0.10$);
R^2=Coefficient of determination.

Item		Summer Rainfall Region									Winter Rainfall Region					
		North-western Free State			Western Transvaal			Transvaal Highveld			Rûens			Swartland		
		1945 to 1970	1970 to 1987	1945 to 1987	1945 to 1970	1970 to 1987	1945 to 1987	1945 to 1970	1970 to 1987	1945 to 1987	1945 to 1970	1970 to 1987	1945 to 1987	1945 to 1970	1970 to 1987	1945 to 1987
Productivity of labour	Growth rate	2.63*	2.24	3.14**	1.25	-0.03	1.59**	2.53*	2.56	3.28**	0.14	3.21**	0.81**	0.61	4.43	0.72
	R^2	33.7	27.0	72.1	52.8	0.01	51.3	47.0	25.9	77.4	4.3	83.9	52.3	23.3	37.3	14.9
Productivity of land	Growth rate	4.61**	1.40	3.96**	3.26*	-0.85	2.11**	3.25**	2.82*	3.25**	2.85**	2.25	2.57**	3.33**	2.42	2.66**
	R^2	63.5	15.7	81.3	74.8	2.57	55.1	71.3	49.6	90.3	97.8	61.5	96.5	97.7	39.2	90.6
Productivity of machinery	Growth rate	-3.82**	-25.24**	-9.55**	-5.27**	-23.1**	-11.2**	-6.05*	-1.91*	-5.57**	0.50	-1.73**	-0.17	0.13	-1.79	-0.84*
	R^2	67.8	98.5	86.0	94.9	98.5	90.7	62.1	73.7	91.7	24.1	91.4	8.3	2.3	14.2	39.5

**,Highly significant ($P<0.05$);*,significant ($P<0.10$);
R^2=Coefficient of determination.

5. Productivity

The increase in productivity of the production factors such as land, capital and labour in the different regions can be calculated by relating gross output to the value of inputs over time (Van Niekerk, 1978; Butterworth and Nix, 1983). These changes for the different periods are shown in Table 8. It can be seen that the mean annual increases in productivity of labour were higher than that of machinery, regardless of the region. This coincides with the results of Joubert and Van Wyk (1984) for total agricultural production.

6. Policy relevance

The identified trends and other characteristics of the agricultural labour market have definite policy implications. Capital is relatively scarce in South Africa, while there is an abundance of unskilled and semiskilled labour available. Capital should thus be used with a great deal of discretion to maximize income and work creation opportunities. Agriculture ultimately yields the largest number of job opportunities per unit of capital invested through the multiplier effect (Mullins and Scheepers, 1980; Van Zyl and Vink, 1988), but can lead to unemployment in the short term.

Development policy should therefore also be centered on creation of job opportunities and the relief of poverty in the intermediate period. However, work opportunities should be productive, and it must, given the scarcity of available resources, be created at the smallest possible cost. The use of capital to enable the growth of agricultural production is therefore not always wrong; it can be essential to use scarce capital to create more job opportunities. Capital should, however, be used for labour-using technology rather than for labour-saving technology (Ishikawa, 1978, 1981), taking into account that management of relatively large numbers of labourers has a cost attached.

Technological progress is generally not neutral to the use of production factors. It can contribute to savings in either labour, capital or land, or a combination of these. Much technology adopted in Southern Africa resulted from research and development in the U.S.A. and other advanced countries where labour is scarce and expensive relative to capital. Van Zyl *et al* (1985) have shown that these technologies, such as maize cultivars, are frequently not suitable for local conditions. It is therefore essential that production techniques and technology in agriculture are adapted to the economic realities of southern Africa.

The appropriate use of available technology in agricultural production is a function of a variety of influences: availability and prices of different factors of production, their relative marginal and average return, financial and managerial status of farmers, investment already incurred in fixed or semi-fixed assets, and also risk or variability attached to any particular technology. The adverse effects of labour displacement, in the light of a relative scarcity of capital, are especially acute in South Africa, given the dualistic nature of the agricultural sector (Van Zyl *et al*, 1985).

The South African authorities should therefore review certain policy aspects that impair job creation opportunities in agriculture which have resulted in distorted prices of the production factors relative to their scarcity. The major measures that kept the cost of capital relatively low were the control of interest rates in general, the subsidization of interest rates in agriculture, and tax concessions on capital investment. These, together with other measures that distort the relative cost of inputs, should be reviewed and modified.

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