# EFFECTS OF LAND PREPARATION AND POSTPLANTING TILLAGE ON WEED CONTROL AND CASSAVA YIELD

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## ABSTRACT

**Two experiments were conducted to determine the effect of land preparation and postplanting tillage on weed control and cassava yield. The first experiment showed that weed biomass and cassava yield were not affected by the method of land preparation. Postplanting tillage, however, significantly affected weed biomass and root number but not root yield.**

**The best three postplanting tillage treatments in the first experiment based on costs and returns, were further tested in a second experiment. Tillage involving off-barring 2 weeks after planting (WAP) followed by handweeding within the row 3 WAP and hilling-up 5 and 7 WAP gave the highest yield and net return.**

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**KEY WORDS:** Cassava. Land preparation. Postplanting tillage. Weed control. Cassava yield.

## INTRODUCTION

Cassava is known to produce relatively good yield even under conditions of minimum input, but this cannot go on indefinitely. To increase yield, it is necessary to use more inputs and/or to improve the cultural management practices.

Most farmers do not have enough capital nor credit to buy additional inputs like fertilizer. Thus to most of them, the sole alternative is to utilize more effi-

ciently their most valuable assets - carabao, plow and labor. Villanueva et al. (1980) found that farmers practise weeding and cultivation, use high-yielding varieties, and select planting materials to a great extent but their awareness and adoption of other practices like fertilization and pest control were rather low.

One of the most expensive and labor-intensive aspects of cassava production is weed control. The agro-economic survey of weeding practices in cassava in Colombia conducted by Doll et al. (1977) showed that the average number of manual weeding was 3.3 times. This represents 50% of the total labor requirement for cassava production and more than one third of the total costs. Catambay (1938) also reported that in cassava production, weeding has high labor requirement next to harvesting.

An effective weed control practice will undoubtedly increase yield. Bacusmo (1978) claimed that controlling the weeds during the first 2 and 6 weeks of cassava growth, respectively doubled and tripled the marketable yield compared with the unweeded control. Since handweeding requires a lot of manpower, combination of handweeding with cultivation like off-barring and hilling-up will probably minimize labor requirement. Moreover, adequate land preparation may reduce weed biomass and the expenses for weeding after planting.

This study presents the effects of land preparation and different postplanting tillage practices on weed control and cassava yield. Estimates of costs and returns of the tillage treatments used are also presented.

## MATERIALS AND METHODS

### *Experiment I*

The experimental area which was previously planted to sweet potato was fallowed for 2 months before land preparation. The soil is Umingan clay loam with pH of 5.3; organic matter, 1.3%; Olsen's P, 32 ppm; and $H_2SO_4$ extractable K, 193 ppm.

The field was plowed and ridged using a carabao-drawn moldboard plow and harrowed with a wooden harrow. The split-plot experiment was laid out using the randomized complete block design (RCBD) with three replications per treatment. The plots measured 7.5 m x 6.0 m and with eight rows for each treatment per replication. The mainplots were the methods of land preparation while the subplots were the postplanting tillage practices. The treatments were as follows:

Mainplot (Land preparation)

- L1 - one plowing (P) followed by (fb) one harrowing (H) one week later
- L2 - 1 P + 1 H fb 1 P + 1 H one week later

Subplot (Postplanting tillage)

- T0 - off-barring (OB) at 2 weeks after planting (WAP) fb hilling-up (HU) at 4 and 6 WAP
- T1 - handweeding (HW) at 2 and 5 WAP

T2 - OB and handweeding within row (HWR) at 2 WAP fb HU at 4 WAP
T3 - HU at 2 WAP fb HU and HWR at 5 WAP
T4 - OB and HWR at 2 WAP fb HU at 4 and 6 WAP
T5 - OB at 2 WAP fb HWR at 3 WAP fb HU at 5 and 7 WAP

Newly-harvested cassava (cv. Golden Yellow) stems were cut into 25-cm length and planted vertically on ridges about 15 cm high at a depth of about 10 cm. Plant spacing used was 75 cm x 75 cm. At planting, 20 g of complete fertilizer (14-14-14) was applied per cutting at about 15 cm away from the hill and 10 cm depth. This is equivalent to 50 kg each of N, $P_2O_5$ and $K_2O$ per hectare. During the first 4 months of growth, the plants were sprayed twice with monocrotophos at 3-5 tbsp/18 L of water to control mites.

Weed biomass was taken through destructive sampling within the six inner rows before every handweeding and/or cultivation and monthly thereafter until 5 months after planting using a 40 cm x 40 cm quadrat. The weeds were air dried (ca. 14% moisture content) before weighing. Leaf area index was monitored during the growing season using 10 sample leaves per 10 sample plants per treatment. The crop was harvested at 6 ½ months after planting. Yield data were taken from 24 hills excluding border plants. At harvest, the storage roots were classified according to size. Roots greater than 3 and 25 cm in diameter and length respectively, were considered big; and the rest, small.

The number of man-hours involved in plowing, harrowing, ridging, fertilization, planting, spraying, handweeding, cultivation and harvesting were noted and used in the cost and return analysis of the different treatments.

*Experiment II*

The best three postplanting tillage treatments based on the cost and return analysis of the first experiment (T0, T2, and T5) were further tested in a second experiment which was also laid out in RCBD. Each treatment was replicated three times.

The area used was an abandoned and weedy sweet potato field. The soil is Umingan clay loam with pH of 5.0, organic matter, 2.0%; Olsen's P, 35 ppm; and $H_2SO_4$ extractable K, 80 ppm.

The land was plowed twice and harrowed once at an interval of one week for each operation. The area was ridged at a distance of 75 cm. The plots measured 27 m x 3 m with four rows each. Urea was applied at planting on a per hill basis at the rate of 120 kg N/ha. Spraying with chemicals was never done. Other cultural management practices and data gathered were similar to that in experiment I.

## RESULTS AND DISCUSSION

*Experiment I*

Rainfall during the growing season was not limiting for cassava

production. The average daily rainfall from the first to the seventh month after planting were 16.6, 8.1, 9.4, 2.4, 5.8, 3.6 and 21.2 mm.

*Weed Biomass*

At 2, 3, 4, and 5 months after planting (MAP), weed biomass was significantly affected by the postplanting tillage but not by the method of land preparation (Table 1). No interaction was observed between land preparation and postplanting tillage. Theoretically, two plowings and harrowings should have controlled the weeds better than just one. However in this study, there was no significant difference between the two methods of land preparation probably because of the short fallow period used and the immediate harrowing of the field after plowing in L2, i.e., without the one-week gap as in L1. Since the experimental area used was planted to root crops for several years, the 2-month fallow period was probably insufficient to make the field very weedy. Moreover; if one-week interval was provided between each plowing and harrowing in L2, it would have taken one month to make the field ready for planting in L2 compared with 2 weeks for L1. In this case, L2 must have controlled weeds better than L1. However, this would change the length of the fallow period. Thus, harrowing in L2 was done immediately after plowing without the time gap of one week as in L1. Results might have been better if the fallow period for L1 was extended by 2 weeks and a one-week interval between plowing and harrowing was provided for L2. A 2-week difference in fallow period between L1 and L2 might not make a big difference in terms of weed control compared with the removal of one-week interval between plowing and harrowing in L2.

The postplanting tillage treatment which did not involve any handweeding (T0) had the highest weed biomass throughout the growing period. This means that cultivation (hilling-up and offbarring) alone is insufficient to control the weeds. However if cultivation is done in two directions perpendicular to each other as practised by some farmers, weed control will be much better.

The high C.V. values suggest that the quadrat size was inadequate. The high weed biomass of T0 at 2 MAP suggests the susceptibility of cassava to weed competition when the canopy is still small. The weed biomass of T0 declined in the succeeding samplings probably due to the increase in canopy cover as shown by greater leaf area during the same period (Table 3) which resulted in shading of the weeds.

The weed biomass of T5 at 2 MAP was rather high considering that it was hilled-up just a week before weed sampling, and it had the most number of separate field operations. This cannot be explained in relation to the treatment. It was probably due to the initial differences in weed population and composition. During this period of sampling, the most prevalent weed

**Table 1.** Weed biomass at 2, 3, 4 and 5 months after planting cassava (cv. Golden Yellow) in the field under different land preparation and postplanting tillage treatments.

| Treatments[1] | Weed Biomass (g/m$^2$, d.w.b.)[2] | | | |
|---|---|---|---|---|
| | Months After Planting | | | |
| | 2 | 3 | 4 | 5 |
| Land preparation (L) | | | | |
| 1 P fb 1 H one week later (L1) | 169.8 | 102.1 | 71.5 | 51.1 |
| 1 P + 1 H fb 1 P + 1 H one week later (L2) | 101.6 | 81.2 | 60.2 | 61.3 |
| Postplanting tillage (T) | | | | |
| OB at 2 WAP fb HU at 4 and 6 WAP (T0) | 583.2a | 298.8a | 182.2a | 95.7a |
| HW at 4 and 6 WAP (T1) | 24.2c | 53.2b | 21.0b | 52.7b |
| OB + HWR at 2 WAP fb HU at 4 WAP (T2) | 25.8c | 44.1b | 36.6b | 43.5b |
| HU at 2 WAP fb HU + HWR at 5 WAP (T3) | 47.9bc | 44.6b | 34.9b | 47.3b |
| OB + HWR at 2 WAP fb HU at 4 and 6 WAP (T4) | 15.1c | 58.0b | 42.5b | 38.2b |
| OB at 2 WAP fb HWR at 3 WAP fb HU at 5 and 7 WAP (T5) | 118.8b | 51.1b | 78.5b | 59.7b |
| F - test | | | | |
| L | ns | ns | ns | ns |
| T | ** | ** | ** | ** |
| L x T | ns | ns | ns | ns |

[1] P = plowing, H = harrowing, OB = off-barring, WAP = weeks after planting, HU = hilling up, HW = handweeding, HWR = handweeding within row.

[2] Within a column, treatment means followed by a common letter are not significantly different at 1% level, LSD.

**Table 2.** Leaf area index of cassava (cv. Golden Yellow) at 2-5 months after planting under different land preparation and postplanting tillage treatments.

| Treatments [1] | Leaf Area Index [2] Months After Planting | | | |
|---|---|---|---|---|
| | 2 | 3 | 4 | 5 |
| Land preparation (L) | | | | |
| 1 P fb 1 H one week later (L1) | 1.99 | 2.18 | 2.47 | 2.56 |
| 1 P + 1 H fb 1 P + 1 H one week later (L2) | 2.08 | 2.13 | 2.22 | 2.29 |
| C.V. (%) | 48.80 | 51.10 | 40.90 | 35.30 |
| Postplanting tillage (T) | | | | |
| OB at 2 WAP fb HU at 4 and 6 WAP (T0) | 1.34b | 1.63 | 1.90 | 2.68 |
| HW at 4 and 6 WAP (T1) | 2.45a | 2.43 | 2.45 | 2.53 |
| OB + HWR at 2 WAP fb HU at 4 WAP (T2) | 2.42ab | 2.61 | 2.89 | 2.97 |
| HU at 2 WAP fb HU + HWR at 5 WAP (T3) | 2.09ab | 2.12 | 2.25 | 2.02 |
| OB + HWR at 2 WAP fb HU at 4 and 6 WAP (T4) | 1.84ab | 2.13 | 2.38 | 2.15 |
| OB at 2 WAP fb HWR at 3 WAP fb HU at 5 and 7 WAP (T5) | 2.05ab | 2.02 | 2.19 | 2.21 |
| C.V. (%) | 24.10 | 24.60 | 23.80 | 26.60 |
| F - test | | | | |
| L | ns | ns | ns | ns |
| T | ** | ns | ns | ns |
| L x T | ns | ns | ns | ns |

[1] P = plowing, H = harrowing, OB = off-barring, WAP = weeks after planting, HU = hilling-up, HW = handweeding, HWR = handweeding within row.

[2] Within the column, treatment means followed by a common letter are not significantly different at 1% level, LSD.

**Table 3.** Simple linear correlation coefficients between LAI or weed biomass and root yield, and between weed biomass and LAI.

| Parameters Being Correlated | r-value |
|---|---|
| LAI at 2 months after planting (MAP) versus root yield | +0.939** |
| Mean LAI versus root yield | +0.962** |
| Weed biomass at 2 MAP versus LAI at 2 MAP | -0.812* |
| Mean weed biomass versus root yield | -0.778ns |

** - highly significant, * - significant, ns - not significant

in T5 was *Digitaria sanguinalis* (L.) Scop.

The dominant weed species observed throughout the sampling period were *Cyperus rotundus* L., *Digitaria sanguinalis* (L.) Scop., *Cynodon dactylon* (L.) Pers. and *Echinochloa colona* (L.) Link.

*Leaf Area Index*

Table 2 shows that leaf area index (LAI) was generally unaffected by land preparation and post-planting tillage treatments. Only LAI at 2 MAP was significantly influenced by the tillage treatments with T0 having the lowest value. LAI values at 2 MAP and the mean LAI during the growing period are significantly and positively correlated with root yield (Table 3) suggesting that one effect of the tillage treatments was on leaf area development. The weed biomass at 2 MAP is significantly and negatively correlated with LAI at 2 MAP (Table 3). This indicates that the amount of weeds only indirectly affected yield through their effect on leaf area development since correlation between weed biomass and root yield revealed no significant correlation.

The coefficients of variation for the leaf area are rather high probably because of the few leaves (10) used per plant. The number of leaves to be used for estimation of leaf area should be increased to reduce the C.V. In current cassava experiments at the Philippine Root Crop Research and Training Center, 20% of the leaves is used as sample size with 10 leaves as minimum. All leaves are used if they number less than 10.

*Cassava Yield*

The different yield parameters as influenced by land preparation and postplanting tillage treatments are presented in Table 4. Except for root number, the other parameters were not significantly affected by the treatments. There was no interaction observed between land preparation and postplanting tillage. The treatment without handweeding (T0) had the greatest amount of weeds during the growing season (Table 1) and the lowest LAI values except at 5 MAP. Consequently, this treatment obtained the lowest values for all the yield parameters excluding the individual root weight.

The least number of roots was observed in T0. This suggests that storage root initiation is more sensitive to weed competition than root bulking since total root yield was not significantly affected. Despite the few roots produced, T0 obtained the highest individual root weight which indicates that harvested roots were small but heavy such that the total root yield did not significantly differ from the other treatments.

There were also no significant differences in root number among treatments T0, T4 and T5. All these treatments involved cultivation either at 6 or 7 WAP. The development of storage roots was possibly affected by cultivation giving some credence to the claim of farmers that cultivation during this period is injurious to the plant.

*Cost and Return Analysis*

The profitability of a given set of recommendations usually determines whether the recommendations will be adopted or not. Thus, T2 is the best treatment because it gave the highest net return. However, T0 also appears to be profitable because its net return is next to T2 despite its very low yield. The high net return for T0 is due to the low treatment cost. On the other hand, the gross returns of T1, T3, and T4 were high but the expenses incurred were also high due to additional labor in handweeding hence, the net returns were low. Based on return on investment, T0 was the most promising treatment followed by T2 and T5.

*Experiment II*

The average daily rainfall during the first to the seventh month after planting were 12.9, 12.1, 4.2, 6.5, 6.1, 1.9 and 8.7 mm.

*Weed Biomass*

Table 6 shows the weed biomass at 2, 4 and 6 MAP under the postplanting tillage treatments showing the highest net returns in experiment I (T0, T2 and T5). Like in experiment I, T0 had the highest weed biomass throughout the duration of the experiment. Weed biomasses of T2 and T5 were comparable which means that the additional cultivation in T5 did not contribute much to the control of weeds. The dominant weeds that occurred during all sampling periods

**Table 4.** Root number, individual root weight, total root yield, total plant weight and harvest index of cassava (cv. Golden Yellow) harvested 6 ½ months after planting under different land preparation and postplanting tillage treatments.

| Treatments[1] | Root Number per $m^2$ | Individual Root Weight (kg)[3] | Total Root Yield (t/ha) | Total Plant Weight (t/ha) | Harvest Index |
|---|---|---|---|---|---|
| Land preparation (L) | | | | | |
| 1 P fb 1 H one week later (L1) | 14.3 | 0.157 | 22.5 | 36.3 | 0.62 |
| 1 P + 1 H fb 1P + 1 H one week later (L2) | 10.5 | 0.171 | 18.0 | 30.0 | 0.60 |
| C.V. (%) | 21.6 | - | 28.7 | 25.6 | 9.90 |
| Postplanting tillage (T) | | | | | |
| OB at 2 WAP fb HU at 4 and 6 WAP (T0) | 13.8c[2] | 0.124 | 17.1 | 29.1 | 0.59 |
| HW at 4 and 6 WAP (T1) | 20.9ab | 0.102 | 21.4 | 34.7 | 0.62 |
| OB + HWR at 2 WAP fb HU at 4 WAP (T2) | 22.0a | 0.106 | 23.3 | 37.7 | 0.62 |
| HU at 2 WAP fb HU + HWR at 5 WAP (T3) | 21.0ab | 0.096 | 20.3 | 32.8 | 0.62 |
| OB + HWR at 2 WAP fb HU at 4 and 6 WAP (T4) | 16.0bc | 0.121 | 19.4 | 31.2 | 0.62 |
| OB at 2 WAP fb HWR at 3 WAP fb HU at 5 and 7 WAP (T5) | 18.8abc | 0.107 | 20.1 | 33.2 | 0.60 |
| C.V. (%) | 22.6 | | 20.8 | 17.9 | 7.30 |
| F - test | | | | | |
| L | ns | | ns | ns | ns |
| T | ** | | ns | ns | ns |
| L x T | ns | | ns | ns | ns |

[1] P = plowing, H = harrowing, OB = off-barring, WAP = weeks after planting, HU = hilling-up, HW = handweeding, HWR = handweeding within row.

[2] Within the column, treatment means followed by a common letter are not significantly different at 5% level, LSD.

[3] These are derived data, hence no C.V. values.

**Table 5.** Simplified cost and return analysis on a per hectare basis for cassava (cv. Golden Yellow) harvested 6 ½ months after planting under different postplanting tillage treatments and averaged across methods of land preparation.[1]

| Postplanting Tillage[2] | Gross Returns[3] (₱) | Treatment Cost[4] (₱) | Net Returns[5] (₱) | Return on Investment[6] |
|---|---|---|---|---|
| OB at 2 WAP fb HU at 4 and 6 WAP (T0) | 7125 | 180 | 3160 | 0.80 |
| HW at 2 and 5 WAP (T1) | 8575 | 3440 | 1350 | 0.19 |
| OB + HWR at 2 WAP fb HU at 4 WAP (T2) | 9350 | 1434 | 4131 | 0.79 |
| HU at 2 WAP fb HU + HWR at 5 WAP (T3) | 7925 | 2420 | 1720 | 0.28 |
| OB + HWR at 2 WAP fb HU at 4 and 6 WAP (T4) | 8025 | 1500 | 2740 | 0.52 |
| OB at 2 WAP fb HWR at 3 WAP fb HU at 5 and 7 WAP (T5) | 8075 | 1468 | 2822 | 0.54 |

[1]Computations based on 1986 pricing in a typical rural area.

[2]OB = off-barring, WAP = weeks after planting, fb = followed by, HU = hilling-up, HW = handweeding, HWR = handweeding within row.

[3]Computed based on farm gate prices of ₱0.50/kg and ₱0.25/kg for fresh big and small cassava roots, respectively.

[4]Computed based on hiring rates of ₱30.00 and ₱20.00/day/person with and without carabao, respectively.

[5]Gross returns minus the treatment cost and the common cost (₱3785) due to land preparation, planting, fertilization, spraying and harvesting.

[6]Computed by dividing net returns by the total cost (treatment cost plus common cost).

were *Cyperus rotundus* L., *Cleome ciliata* Schum. and Thonn., *Commelina diffusa* Burm. f., *Digitaria sanguinalis* (L.) Scop. and *Echinochloa colona* (L.) Link. Other less prevalent weeds observed were *Vernonia cinerea* (L.) Less., *Euphorbia hirta* L., *Portulaca oleracea* L., *Ipomoea triloba* L. and *Eleusine indica* (L.) Gaertn.

**Table 6.** Weed biomass at 2, 4 and 6 months after planting cassava (cv. Golden Yellow) in the field under different postplanting tillage treatments.

| Treatment[1] | Weed Biomass (g/m², d.w.b.)[2] | | |
|---|---|---|---|
| | Months After Planting | | |
| | 2 | 4 | 6 |
| OB at 2 WAP fb HU at 4 and 6 WAP (T0) | 79.6a | 513.8a | 144.6a |
| OB + HWR at 2 WAP fb HU at 4 WAP (T2) | 36.6a | 98.4b | 55.4b |
| OB at 2 WAP fb HWR at 3 WAP fb HU at 5 and 7 WAP (T5) | 45.2a | 104.8b | 46.2b |
| C.V. (%) | 35.2 | 22.3 | 28.6 |

[1]OB = off-barring, fb = followed by, HU = hilling-up, HWR = handweeding within row, WAP = weeks after planting.

[2]Within a column, treatment means followed by a common letter are not significantly different at 1% level, LSD.

*Cassava Yield*

Table 7 presents some yield parameters of cassava as affected by the tillage treatments. The treatments significantly affected the number and weight of big roots, total root weight and total plant weight (TPW). T5 which involved the most number of cultivation (one off-barring and two hilling-ups) produced the highest number and weight of big roots, total root weight and TPW. The major effect of handweeding and cultivation seems more on root development since herbage yield (the above ground component of TPW) was not affected. Total root number was also not significantly affected.

The effects of the treatments are more evident in Table 8 which shows that total root yield is positively and significantly correlated with individual root weight, total plant weight and harvest index. Results suggest that the main effect of cultivation is to provide the roots more leeway for expansion. This is probably the reason why there were

**Table 7.** Root number, root yield, herbage weight, total plant weight, and harvest index of cassava (cv. Golden Yellow) under different postplanting tillage treatments and harvested 6 ½ months after planting.[1]

| Yield Parameter | Postplanting Tillage[2] | | | C.V. (%) |
|---|---|---|---|---|
| | T0 | T2 | T5 | |
| Big roots (#/m²) | 5.4b | 5.8b | 7.2a | 5.1 |
| Small roots (#/m²) | 10.3a | 10.5a | 10.5a | 7.0 |
| Total roots (#/m²) | 15.7a | 16.3a | 17.7a | 4.1 |
| Big root weight (t/ha) | 15.5b | 16.1b | 22.4a | 8.6 |
| Small root weight (t/ha) | 6.5a | 7.9a | 7.9a | 18.9 |
| Total root weight (t/ha) | 22.0b | 24.0ab | 30.3a | 10.6 |
| Herbage weight (t/ha) | 29.4a | 32.3a | 33.0a | 9.9 |
| Total plant weight (t/ha) | 51.4b | 56.3ab | 63.3a | 6.8 |
| Harvest index | 0.43a | 0.43a | 0.48a | 8.8 |

[1] Within a row, treatment means followed by a common letter are not significantly different at 5% level, LSD.

[2] T0 = off-barring (OB) at 2 weeks after planting (WAP) followed by (fb) hilling-up (HU) at 4 and 6 WAP, T2 = OB and handweeding within row (HWR) at 2 WAP fb HU at 4 WAP, and T5 = OB at 2 WAP fb HWR at 3 WAP fb HU at 5 and 7 WAP.

more big roots in T5. The only difference between T2 and T5 is the additional hilling-up in the latter, yet their yield of big roots significantly differed. Between the sixth and seventh WAP, 261 mm of rainfall was recorded. This might have compacted the soil but the additional hilling-up in T5 most probably loosened the soil and provided more favorable condition for later expansion of the roots.

Janick (1972) asserted that cultivation and tillage are such widespread practices and many have come to believe that loosening of the soil has beneficial functions aside from weed control. In the case of root crops like cassava, soil loosening seems very beneficial as results of this study indicate. Moreover, Lal (1980) found that fresh and dry weights of cassava were significantly reduced at higher bulk density.

**Table 8.** Simple linear correlation coefficients between total root yield and some selected data for cassava (cv. Golden Yellow) harvested 6 ½ months after planting.

| Parameter | r-value |
|---|---|
| Weed incidence at 2 months | -0.58ns |
| Leaf area index (LAI) at 2 months | 0.60ns |
| LAI at 6 months | 0.53ns |
| Root number | 0.54ns |
| Individual root weight | 0.93** |
| Total plant weight | 0.87** |
| Harvest index | 0.86** |

ns - not significant, ** - highly significant

Increase in bulk density also adversely affected root-shoot ratio. In sandy soils, however, cultivation might not have any beneficial effect in terms of soil loosening. Unpublished results of a farmer's field trial on tillage showed that plain hand-weeding was as good as hand-weeding plus hilling-up and off-barring.

*Cost and Return Analysis*

Cost and return analysis (Table 9) shows that the best treatment in terms of net income and return on investment is T5. Although T2 has higher net income than T0, the return on investment is higher in the latter than in the former treatment.

*General Recommendations*

Based on the results of the two trials and assuming that growing conditions are more or less similar to those prevailing during the conduct of the experiments, it is recommended that the field be plowed, harrowed, and ridged once if it is not weedy. If it is relatively weedy, one or more plowing and harrowing should be added. The field should also be off-barred 2

**Table 9.** Simplified cost and return analysis on a per hectare basis for cassava (cv. Golden Yellow) harvested 6 ½ months after planting under different postplanting tillage treatments.[1]

| Treatment[2] | Gross Returns[3] (₱) | Treatment Costs[4] (₱) | Net Returns[5] (₱) | Return on Investment[6] |
|---|---|---|---|---|
| OB at 2 WAP fb HU at 4 and 6 WAP (T0) | 9375 | 180 | 6855 | 2.72 |
| OB + HWR at 2 WAP fb HU at 4 WAP (T2) | 10025 | 506 | 7179 | 2.52 |
| OB at 2 WAP fb HWR at 3 WAP fb HU at 5 and 7 WAP (T5) | 13175 | 740 | 10095 | 3.27 |

[1]Computations based on 1986 pricing in a typical rural area.

[2]OB = off-barring, WAP = weeks after planting, fb = followed by, HU = hilling up, HWR = handweeding within row.

[3]Computed based on farm gate prices of ₱0.50/kg and ₱0.25/kg for fresh big and small roots, respectively.

[4]Computed based on hiring rates of ₱30.00 and ₱20.00/day/person with and without carabao, respectively.

[5]Gross returns minus the treatment cost and the common cost (₱2340) due to land preparation, planting, fertilization and harvesting.

[6]Computed by dividing net returns by the total cost (treatment cost plus common cost).

WAP, handweeded within the row 2 to 3 WAP, and then hilled-up once at 4 to 7 WAP depending on weed growth and soil compaction. Two hilling-ups may be done between 4 and 7 WAP if weeds are still abundant and the soil is too compacted due to heavy rains. This tillage recommendation is essentially based on treatments T2 and T5.

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