# AN ECOLOGICAL SURVEY OF THE WEED FLORA IN THE MAJOR ROOT CROP AREAS IN THE PHILIPPINES

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## ABSTRACT

**Different root crop-growing areas in the Philippines were surveyed during the wet season to determine the weed species associated with different root and tuber crops, namely, sweet potato, cassava, yam and white potato. Wet season quantitative vegetation analysis of weed species associated with root crops in the Philippines has shown the existence of 8 weed community types, namely:** *Cyperus rotundus, Paspalum conjugatum, Ageratina adenophora, Pennisetum polystachyon, Digitaria sanguinalis, Dactyloctenium aegyptium, Eragrostis tenallla,* and *Desmodium triflorium*. **A total of 70 weed species was encountered in the quantitative vegetation analysis. Some environmental factors such as pH, climatic type, soil type, weed control practices and elevation were determined to explain the community patterns.**

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**KEY WORDS:** Weed flora. Weed community types. Root crops. Sampling. Ecological survey. Philippines.

## INTRODUCTION

Studies of weed communities are important for the management and control of weeds because of the significant damage they cause to crops, fisheries and pastures. Knowledge of the community patterns of weeds and the effects of edaphic, climatic and biotic factors on their growth and reproduction can give insights into the mechanism of speciation and distribution of the species. Such studies reveal the interactions between species and their environment, and thus offer an opportunity to locate vulnerable points at which the weeds can be successfully controlled (Misra, 1969).

Root crops, such as cassava *(Manihot utilissima* Pohl.), sweet potato *(Ipomoea batatas* (L.) Poir.) and yam *(Dioscorea alata* L.), have been propagated in many tropical countries of the world. In the Philippines, the five leading root crop-producing regions (based on quantity produced) are Bicol, Eastern Visayas, Northern Mindanao, Central Visayas and Cagayan Valley (Baecon, 1972). In recent years, interest in root crops increased due not only for their traditional use as human food but also for animal feedstuff and industrial use (Hammond, 1977). However, root crops, which are the dominant species in the field, have been observed to be inhabited by many weed species competing with almost all the crop requirements,and this poses as one of the pernicious problems of root crop growers.

In this study, a quantitative vegetation survey was conducted to determine the existing weed community types associated with major root crops in the different regions of the Philippines. An attempt was also made to explain community patterns in terms of environmental parameters such as cropping history, climate (rainfall), soil types, soil pH, elevation, cultural practices, and weed control practices.

## METHOD

A survey of the dominant weed species associated with major root crops such as cassava, sweet potato, yam and potato was conducted in Nueva Ecija, Benguet, Lanao del Sur, Leyte, Camarines Sur, Antique and Bukidnon (Fig. 1). The areas surveyed were: Central Luzon State University (CLSU), Mountain State Agricultural College (MSAC), Buhi, Camarines Sur, Visayas State College of Agriculture (ViSCA), Malabang, Lanao del Sur, Antique Upland Development Program (AUDP), San Jose, Antique, Pantabangan, Nueva Ecija and Phil-Agro, Imbatug, Bukidnon.

The weed species associated with major root crops were recorded and related according to the different climatic types, soil types, soil pH, elevation, cropping history, cultural practices and weed control practices. The climatic types were based on Corona's (1920) classification, namely:

Type 1 — two pronounced seasons: dry from November to April; wet during the rest of the year;

Type II — No dry season with a very pronounced maximum rainfall from November to January;

Type III — Seasons not very pronounced; relatively dry from November to April and wet during the rest of the year;

Type IV — Rainfall more or less distributed throughout the year.

Regression analysis was used to test the relationship between dissimilarity values and distance of sample plot.

Sample plots measuring 1 sq m were obtained from root crop areas in each province surveyed. Before sampling, the area was divided by reconnaissance survey to determine the relative homogeneity of the

vegetation. The number of samples taken was determined by the size of the root crop area with a minimum of two samples (Table 1).

Random sampling was done by throwing quadrats, each quadrat representing one sample plot. Harvest or biomass method was used in vegetation sampling. Samples were collected when the crops were at the following stages, except in Buhi and Pantabangan, where cassava was at its reproductive stage:

| Crop | Age (Months) |
|---|---|
| Sweet potato | 2 |
| Cassava | < 4 |
| White potato | 2 |
| Yam | 3 |

## RESULTS AND DISCUSSION

*Weed Community Type (Wet Season).*

Fig. 2a and 2b show the results of sample plot arrangement of two major root crops based on floristic composition in a two-dimensional ordination diagram. The correlation coefficient between dissimilarity values and distance of sample plots in the ordination diagram is significant (r = 0.74). Aggregation of sample plots, therefore, can indicate distinct community types. A community type will be defined by a single species or a combination of species that have restricted range of

**Table 1.** Sample plot number, sample location and climatic types of root crop areas (sweet potato, cassava, potato, yam) included in quantitative vegetation analyses.

| SAMPLING LOCATION | PLOT NUMBER | | | | CLIMATIC TYPE[1] |
|---|---|---|---|---|---|
| | Sweet potato[2] | Cassava[2] | Potato[3] | Yam[4] | |
| ViSCA, Baybay, Leyte | 5,6,7,8,13, 14,15,16 | 21,22,23,24<br>1, 2, 3, 4 | | 1,2,3,4<br>1,2,3,4 | II<br>I |
| CLSU, Nueva Ecija | 9,10,11,12 17,18,19,20 | | | | I |
| MSAC, La Trinidad, Benguet | 1,2,3,4,21 22,23,24 | | 1,2,3,4<br>1,2,3,4 | | I |
| AUDP, San Jose, Antique | 17,18,19,20 25,26,27,28 | 35,36,37,38<br>5, 6, 7, 8 | | | I<br>III |
| Buhi, Camarines Sur | 13,14,15,16 29,20,31,32 | 31,32,33,34<br>3,10,11,41 | | | IV |
| Malabang, Lanao del Sur | — | 27,28,29,30 35,36,37,38 | | | IV |
| PhilAgro, Imbatug, Bukidnon | — | 39,40,41,33 34,40 | | | I |
| Pantabangan | — | 25,26,12,39 | | | |

[1]Based on Corona's classification (1920).
[2]Found in almost all the surveyed area.
[3]Major root crop grown in MSAC, La Trinidad Benguet in addition to sweet potato.
[4]Another major root crop grown in ViSCA, Baybay, Leyte in addition to sweet potato and cassava.

distribution over the entire root crop area.

Results show that there are 8 main weed community types of cassava and sweet potato in the surveyed areas in the Philippines, namely: *Cyperus rotundus, Paspalum conjugatum, Ageratina adenophora, Dactyloctenium aegyptium, Eragrostis tenella, Pennisetum polystachyon, Desmodium triflorium* and *Digitaria sanguinalis.* Likewise, one sample plot (No. 15) collected from Buhi was dominated by *Ageratum conyzoides.* However, since only one sample plot was characterized by the dominance of this species, it was not considered as a community type.

*Floristic Composition.*

There were 70 weed species encountered in cassava and sweet

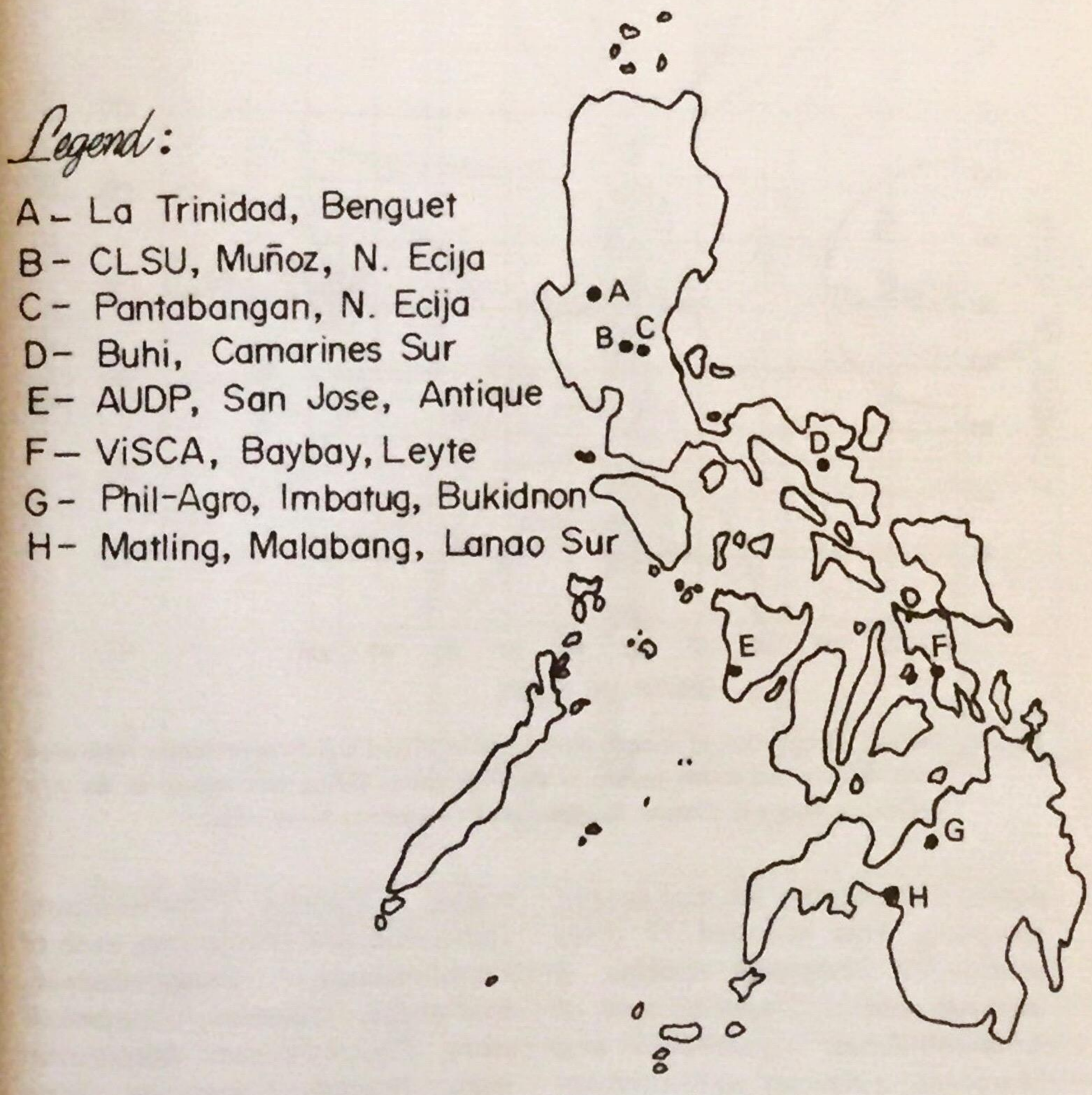
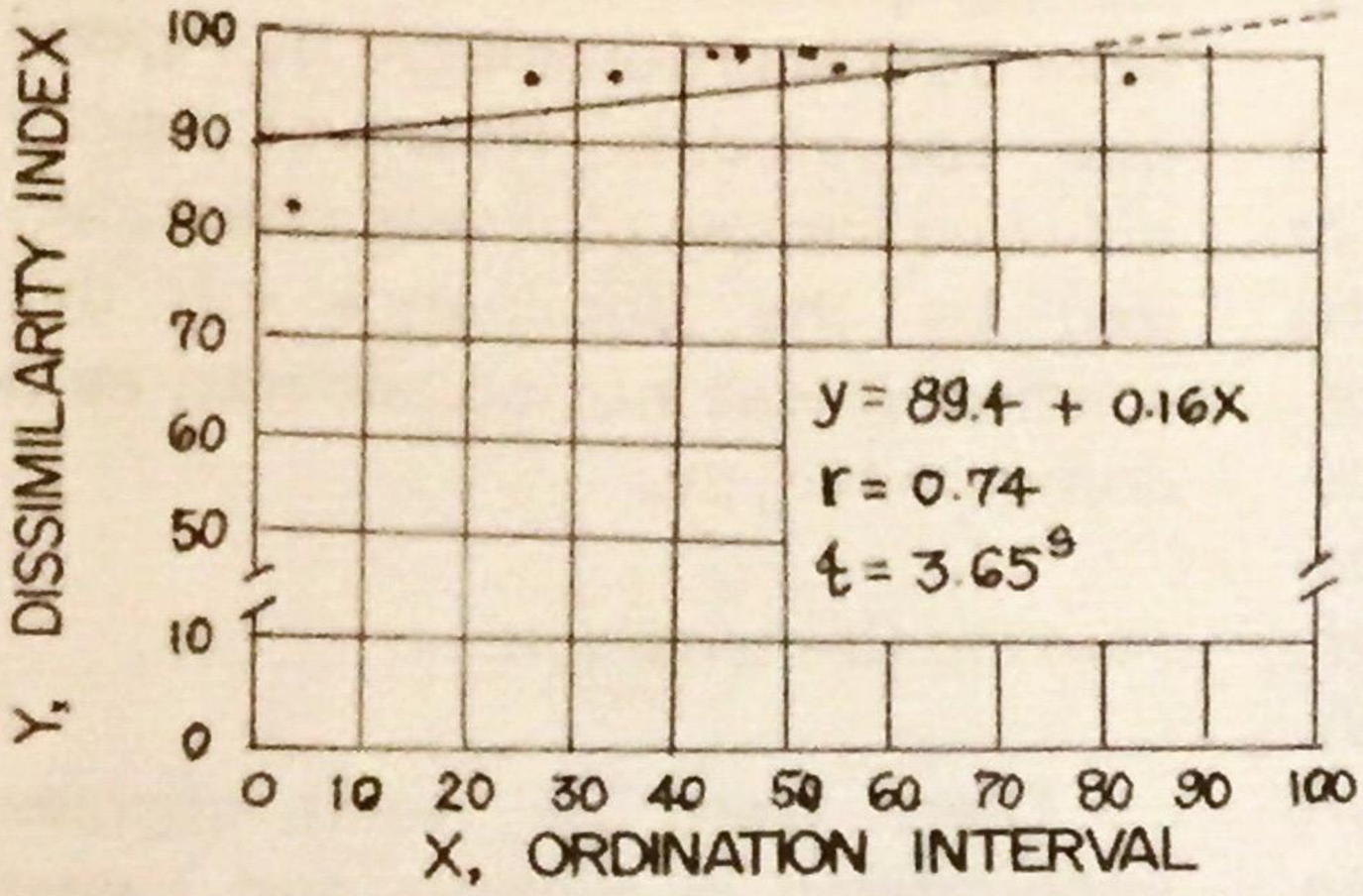



**Fig. 1.** Map of the Philippines showing the different sampling sites for quantitative vegetation analyses of weed communities associated with cassava and sweet potato.




*Legend:*

▲ – Pennisetum polystachyon
△ – Ageratina adenophora
□ – Dactyloctenium aegyptium
■ – Cyperus rotundus
⊡ – Eragrostis tenella
○ – Paspalum conjugatum
⊖ – Ageratum conyzoides
● Mixture of Desmodium triflorum & Digitaria sanquinalis (see Figure 2b)

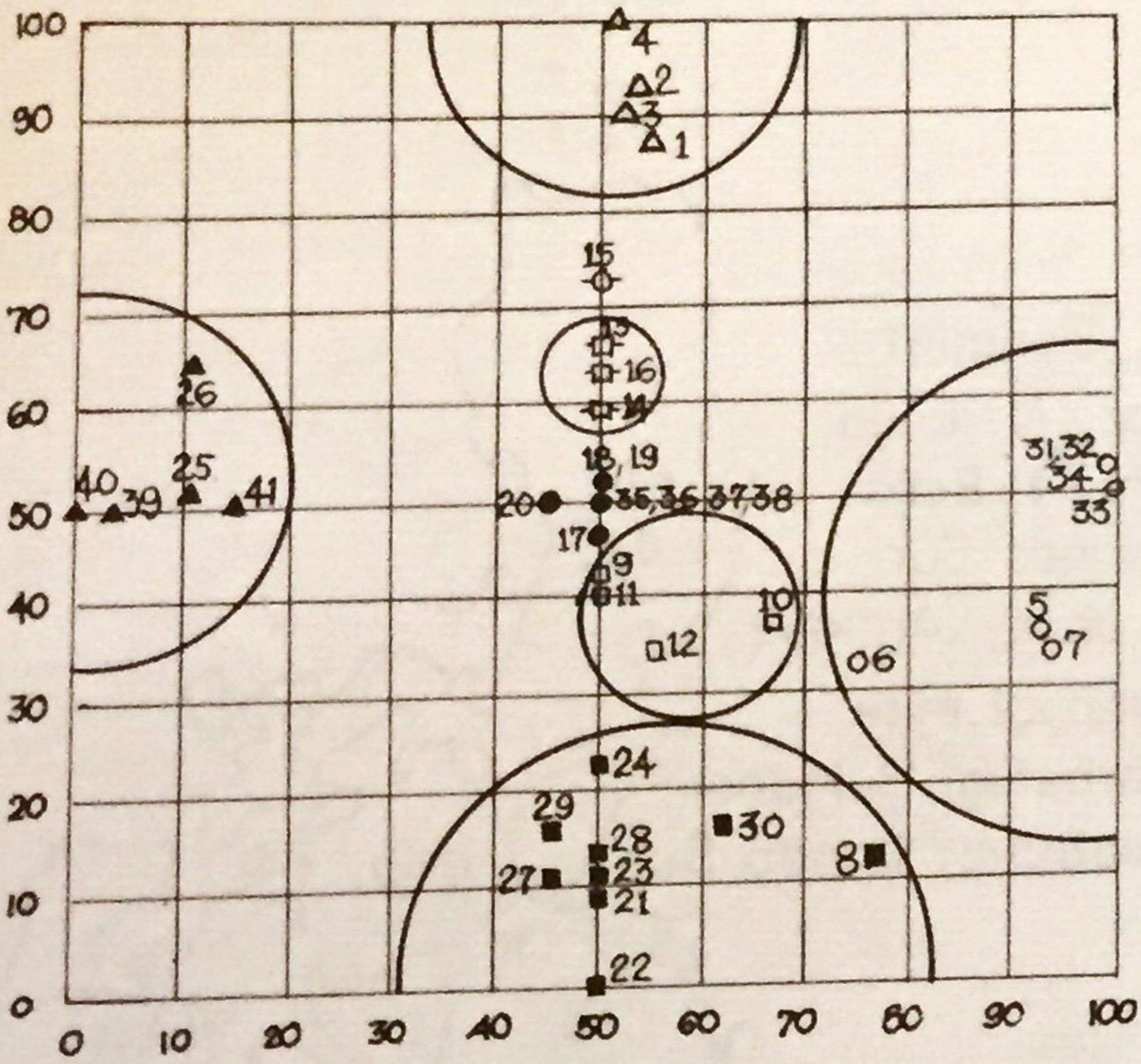



**Fig. 2a.** Below: Distribution of sample plots obtained from weed communities associated with cassava and sweet potato in the Philippines during wet season in the x/y ordination diagram. Above: Regression of 13 random releve pairs.

potato fields during the wet season sampling. This included 17 grass species, 7 composite species, 8 legumes species, 3 species each of Amaranthaceae, Cyperaceae and Moraceae, 2 species each of Aizoaceae, Commelinaceae, Euphorbiaceae, Labiatae, Orchidaceae, Tiliaceae, Araceae, Verbenaceae, Rubiaceae, and one species each of Passifloraceae, Selaginellaceae, Malvaceae, Iridaceae, Capparidaceae, Polypodiaceae, Convolvulaceae, Pontederiaceae and Oxalidaceae.

The different environmental fac-

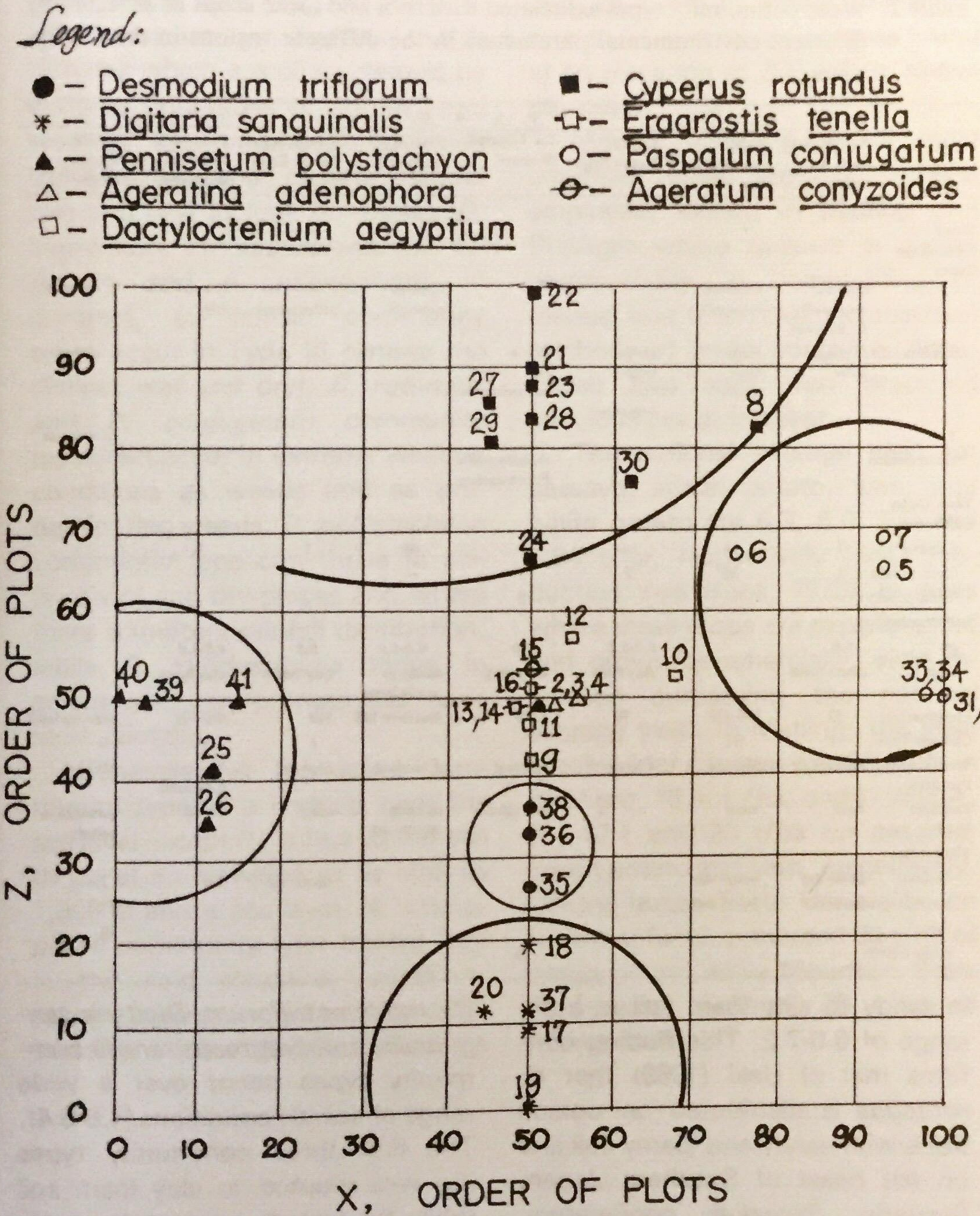



**Fig. 2b.** Ordination of x/z values of the 41 releves showing a clearer separation of *Desmodium triflorum* and *Digitaria sanguinalis*.

tors affected the growth and establishment of weed species (Table 2). Almost all upland sites sampled contained *C. rotundus* as a weed; in ViSCA and Matling it existed as a dominant weed species. Thus, *C. rotundus* can very well adapt to a variety of soil types (Justice and Whitehead, 1946) and a wide range of soil pH. However, in places where it existed as dominant weed species, *C. rotundus* occurred only

**Table 2.** Weed community types associated with root and tuber crops as affected by different environmental parameters in the different regions in the Philippines.

| | PLACES | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **AUDP, San Jose, Antique** | **Buhi, Camarines Sur** | **CLSU, Nueva Ecija** | **La Trinidad, Benguet** | **Matling, Malabang** | **Pantabangan, Nueva Ecija** | **Phil-Agro, Imbatug, Bukidnon** | **VISCA Baybay, Leyte** |
| **Weed Community Types** | | | | | | | | |
| Cassava | *Digitaria sanguinallis* *D. triflorum* | *Paspalum conjugatum* | | | *Cyperus rotundus* | *Pennisetum polystachyon* | *P. polystachyon* | *C. rotundus* |
| Sweet potato | *D. sanguinallis* | *Eragrostis tenella* | *Dactyloctenium aegyptium* | *Ageratina adenophora* | | | | *C. rotundus* |
| Yam | | | | | | | | *C. rotundus* |
| White potato | | | | *A. adenophora* *P. conjugatum* | | | | |
| **Years Under Cultivation** | | | | | | | | |
| Cassava | 2 | 1 | — | — | 60 | 1 | 3 | |
| Sweet potato | 2 | 30 | 3 | 5 | — | — | — | |
| White potato | — | — | — | 15 | — | — | — | |
| **Soil Property** | | | | | | | | |
| ph | 6.0 | | 5.0-5.5 | 4.6 | 6.0-6.5 | 5.2 | 4.5-5.0 | |
| type | sandy loam | | clay loam | salty clay | sandy to sandy loam | clay loam | clay loam | |
| **Elevation (m)** | 52 | 100-130 | 70 | 1300 | less than 200 | 300 | 500-700 | near sea level |
| **Climatic Type** | I | III | I | | | I | IV | II |
| **Weed Control Practices** | Manual | Manual | Chemical | Manual | Chemical | Manual | Manual Chemical | Manual |
| **Fertilizer Used** | none | none | | (60-120-60) | (0-18-0) 80-120-60 | none | 0-0-60 | ammonium sulfate |
| **Yield (t/ha)** | | | | | | | | |
| Cassava | home use | home use | | | | home use | 1.5 | 2.0 |
| Sweet potato | home use | home use | 30 | | | | | 17.1 |
| Yam | | | | | | | | 20 |
| White potato | | | | 25 | | | | |

in sandy to silty loam soil at a pH range of 6.0-7.2. This finding confirms that of Ueki (1969) that *C. rotundus* is distributed on upland fields with sandy and loamy soil and on the coast of Southern Japan. Similarly, *Paspalum conjugatum,* now present in all tropical and subtropical regions (Kasasian, 1971), occurs also with the same soil type and pH range as is *C. rotundus. Pennisetum polystachyon, Echinocloa colona, Dactyloctenium aegyptium, Ageratina adenophora, Ageratum conyzoides, Hyptis suaveolens, Desmodium triflorum, Digitaria sanguinalis,* and *Eragrostis tenella* community types occur over a wide range of soil pH conditions (4.5-6.4). The first three community types are well-adapted to clay loam soil while the last six community types are adapted to soil types ranging from sandy clay loam to silty clay loam. On the other hand, *Cleome rutidosperma* community type is adapted to silty loam soil at pH 7.2.

Based on Corona's system of classification, *A. conyzoides* and *D. sanguinalis* community types can

occur over a wide range of moisture conditions, i.e., on Types I and III climates which are characterized by extreme conditions of dryness and wetness. Community types which thrive best in Type I climate (distinct wet and dry) include *E. colona, D. aegyptium, H. suaveolens, D. triflorum,* and *A. adenophora.* In contrast, *E. tenella* community types occur in Type III climate (no distinct wet and dry). *C. rotundus* and *P. conjugatum* community types can occur in extreme weather conditions as weeds and as predominating weeds. *P. polystachyon* community type can thrive in distinct wet and dry places and where there is uniform rainfall distribution, while *C. rutidosperma* thrive in places with very pronounced maximum rainfall.

Generally, all the weed community types are located near the sea level except for a few which can thrive at an elevation of as high as 1,300 m above sea level. *A. adenophora* community type thrives best in the said elevation, while its relative *Ageratum,* at both extreme conditions (near the sea level to as high as 1,300 m above sea level). Foxtail *(P. polystachyon)* was found at an elevation of 300-700 m above sea level.

Manual weeding is the most common weed control method employed, except in Matling and PhilAgro where cassava is grown commercially. A combination of manual (use of scythe) and chemical methods of weed control is done. These two sites also practiced judicious use of fertilizer.

The national average yield for cassava, sweet potato, yam, and white potato are 5.3, 5.0, 5.0 and 5.84 t/ha, respectively (FAO Production Year Book, 1973). In areas where these crops are experimented and grown commercially, yield increased surpassing the national average yield. In Matling, the yield obtained for cassava was 25 t/ha; in PhilAgro, 15 m.t./ha, and in ViSCA, 20, 17.1 and 20 t/ha for cassava, sweet potato and yam, respectively. Central Luzon State University, on the other hand, produced 30 t/ha of sweet potato while Mountain State Agricultural College, 25 t/ha of white potato.

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