VERNONIA PRODUCTION IN NICARAGUA
TRIP #4
MANAGUA, NICARAGUA

Assignment Number: ST-196

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THROUGH

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UNDER THE AUSPICES OF:

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Guatemala City, Guatemala

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VERNONIA IN NICARAGUA
TRAVEL TO NICARAGUA. MARCH 20-27, 1994
BY ROBERT E. PERDUE, JR.

Summary

We have three vernonia plantings in Nicaragua, the Cesar Lanuza planting of 60 manzanas (104 acres), the Anibal Mayorga planting of 30 manzanas (52 acres) and the CEA planting of 2 manzanas (3.5 acres). Vernonia is thriving at each.

The Mayorga planting had not been irrigated since February 19 because of a problem with the irrigation pump, and I thought we would loose this planting. The problem with the pump has proved a blessing. Vernonia is deep rooted and continues to thrive while the weeds, most of which are shallow rooted, have turned brown and are no longer active. There will be a good crop here. It is evident from this planting that vernonia requires much less irrigation than we anticipated.

The Mayorga planting illustrates, better than anything I have earlier observed, the importance of drought stress in vernonia seed production. We need experiments to establish the optimal irrigation regimen - how much water to apply and when. When we have determined this we will increase seed production, decrease irrigation cost and reduce time from planting to harvest.

The CEA planting had last been irrigated on February 28 and there was still ample soil moisture when I visited three weeks later. There will be no further irrigation of this crop. Total water applied during the season was 538 mm (21.2 in) and it is evident this is more than enough.

The cost to date at the Lanuza site where we have the best records is $283 per manzana ($164 per acre), well under our anticipated cost. The total cost includes a very substantial investment in labor to control nutsedge. We can greatly reduce this cost in the future by controlling this weed with herbicides and/or planting with greater distance between rows to permit mechanical cultivation.

We will adapt a cotton harvester to vernonia harvest. ANSCA will provide a harvester and Instituto Polytechnico La Salle will fabricate a "pick-up" to be mounted on the harvester so vernonia seed can be vacuumed from the grown. We will windrow plants, allow them to dry so seed will fall to the ground, cast off the stems and then vacuum seed with this giant "vacuum cleaner".

I am more than ever confident we will succeed with vernonia in Nicaragua and this country will become the vernonia "breadbasket".
We have had our share of problems but so far (now that we recognize and can anticipate them), none that we cannot cope with.

Travel costs were provided by PROEXAG II, Guatemala City, and I appreciate this support. In Guatemala PROEXAG also provided transportation and Javier Siliezar as driver and interpreter. In Nicaragua APENN provided transportation and Claudio Martinez and Rene Landgrand as advisors, guides and interpreters. I am indebted to APENN for their support and to Patrick Bolaños, General Manager, for the time he devoted to me. I sincerely appreciate the enthusiasm and support of all at APENN and the contribution they are making to development of vernonia as a new crop in Nicaragua.

I was accompanied by my wife, Dr. Georgia Perdue, Ver-Tech, Inc. Vice President and Secretary.

My main objectives were to visit vernonia plantings in Guatemala on the farms of Antonio Cristiani and Michael Frank established in late 1993 and examine the three vernonia plantings in Nicaragua (by Cesar Lanuza, Anibal Mayorga and at CEA) established in November 1993 - January 1994. Other objectives in Nicaragua were to return to ANSCA to evaluate the suitability of equipment here for cleaning vernonia seed, visit the La Salle School in Leon to arrange for fabrication of a "pick-up" mechanism to be attached to a cotton harvester for vacuuming vernonia seed from the ground, try to locate a corn sheller similar to the one we used in Costa Rica for debearding vernonia seed and visit Johan Brun, Danish advisor to ACAESA, a company that controls several farms near Leon and Chinandega.

GUATEMALA

Vernonia is finally becoming photogenic. Photographs are attached, arranged in eight "plates".

Cristian Rodriquez, Agri-Lab, Guatemala City:

He had contacted me earlier by fax at the suggestion of Mark Gaskell. Met him briefly at my hotel. Agri-Lab provides a variety of services to farmers: soil, tissue, water and fertilizer analyses, services in plant pathology and nematology, consulting and extension. These are services we do not need at the present time but they will be useful in the future.

Cristiani Burkard farm near Tiquisate:

I met Antonio Cristiani when I visited Guatemala in October 1993 (see report on that trip for further details). Vernonia was planted here October 21, November 17 and December 22, 1993 in a well designed experiment.

Plate 1, above: This painting was on a wall in the farm office. No explanation needed. I hope that in time we can replace automatic rifles with vernonia.

Plate 1, center: The October 21 planting, plants about 3.5 ft tall.
Plate 1, below: The November 17 planting, plants about 4 ft tall, severe lodging on the left.

At first glance, it appeared there would be a good yield of seed as there were many flowerheads. But no seed. Either seed had not set or were later aborted. I am almost certain (because of subsequent observations in Guatemala and Nicaragua) this is due to excessive soil moisture. This response has been observed in Haiti where vernonia was grown under drip irrigation with excessive water and at two sites NE of Guatemala City where vernonia was grown on shallow soils over heavy clay. Roots could not penetrate the heavy soil and spread out just below the surface. These plantings required continual irrigation to prevent wilting. Lush vegetative growth but no seed. Also reported in Israel by David Mills, Ben Gurion University of the Negev. According to Mills (in a research proposal submitted to USAID), observations on vernonia in Israel ".....indicate that under intensive watering seeds do not reach full maturity (although plants exhibit enhanced vegetative growth accompanied by production of many flowerheads)."

Farm of Guillermo and Ricardo Fuentes near Tiquisate:

They met us at the Cristiani Burkard farm and asked that I visit their farm Hacienda Santa Isabel. They grow sesame and sorghum and want something new. They are members of Cooperativa Agricola del Sur which has 68 members, mostly sorghum growers (a few grow melons). Their farm is on higher ground and rolling land. The soil is derived from pumice and appears to be a clay. But they say it dries out soon after rain so I suspect it is silt. Vernonia has performed very well on silts derived from limestone in Belize, Haiti, and Dominican Republic and I suspect it will do well here. They will try.

Mike Frank farm near Cerro Colorado:

Again, no seed. The soil was so hard I could not penetrate it with my auger but I was able to dig down about 6 in with my pick where the soil was moist. According to Mike the water table rises during the dry season due to high Pacific tides. The foreman showed me "seed" collected from a planting the previous year and these too were either very small or aborted.

If vernonia is to be grown in Guatemala it will have to be on higher ground without a high water table.

NICARAGUA

Anibal Mayorga farm near Leon:

Seed were planted December 14-29. When Hoard Beebout and I visited here during the morning of February 22, we were told that the irrigation pump had broken down a few days earlier but that
it would be pulled and repaired that day. When we returned that afternoon we were advised that the well housing had collapsed and the pump could not be removed. This looked like a disaster.

We visited here on March 22, expecting to seed a field of dead vernonia plants. On the contrary, that breakdown appears to be the best thing that could have happened.

Plate 2 is a panoramic view of the Mayorga planting. The field is rectangular with the long dimensions extending north/south. The six photos used for the panorama were taken from the west side of the field. The view extends through 180 degrees from due north to due south. The right side of the upper series and the left side of the lower series are the view to the east.

The panorama shows the west side of the field where we had the best weed control and this is not representative of the east side where weed control was poor. Nor is it representative of the far south end of the field which is shown in Plate 5.

Plants are still thriving and there is good seed set. Many plants are fresh and green and producing more young flowerheads so they must still be physiologically effective.

Plate 3 shows two views to the southeast from a point in the middle of the west side of the field. The plants here are about 2 ft tall.

From a series of observations over the years I have suspected that some variations in vernonia development are due not to heredity but to the environment. Plate 4 strengthens (if not confirms) this view. These photos were made on the west margin of the field.
The upper left photo shows a transect from the area in the foreground which received very little water during irrigation to an area in the background that received a generous amount of water. The very small plants in the foreground have flowerheads but the plants are excessively stressed and probably will not produce mature seed.

The plant in the upper right photo is typical of those at the midpoint of the transect. It has received adequate but not excessive moisture. Note that the flowerheads are on very short branches. All the flowerheads are beyond the flowering stage. The plant is investing its energy in seed maturation not in more vegetative growth or new flowers. All seed will mature at the same time.

The plant in the lower right photo is from the area that was watered generously. It received

more than enough water (probably much more than desirable). The flowerheads are on very long branches. There are still at least two very young flowerheads. Note the small flowerheads with lavender florets in the upper left and right corners. As these young flowerheads develop, the branches bearing them will continue to elongate, mature flowerheads will be at least three levels and all seed will not mature at the same time.

The lower left photo shows two plants with "short stems" and one with "long stems". The plant in the center was 17 in tall. The tap root broke off at 5 in below the surface. Vernonia roots have to penetrate very deep to draw moisture from the lower layers of the soil. A hydrologist in Arizona has determined that on a sandy loam they can draw moisture from a depth of 4 ft.

The plant in the upper right of Plate 4 is the type we want to maximize seed production and minimize production costs. This plant is investing a minimum of its energy in stems and leaves and a maximum in seed. It will take some experimentation to consistently duplicate this kind of development. It is a matter of the right amount of water at the right time.

The lower leaves of this plant (Plate 4, upper right) and many others were severely wilted and drooping. But when the leaves are crushed in the hand they obviously still contain much moisture. These plants are draining moisture and nutrients from the leaves to mature the seed. We first visited the Mayorga planting during the hottest part of the day and I saw many plants with upper leaves slightly wilted. Early the following morning the upper leaves had completely recovered and many plants had new flowerbuds that had opened during the night. There is still adequate moisture in the soil and these plants are still actively growing.

The photos in Plate 5 were taken near the south end of the field. Seed were sown in rows 12 in apart. The lower photo is a view from above. Note the dark-brown "eye" of the flowerheads. On these plants the eyes are about 4/10 in diameter and they will increase to 8/10-1 in before the seed mature. (In contrast, the eyes on flowerheads at the Cristiani farm in Guatemala were barely 1/10 in diameter.) These plants are currently at the stage of our Costa Rica crop at harvest time and here there is still good soil moisture so we should get a far better harvest than in Costa Rica.

Note in Plate 5 and in the upper two photos of Plate 4 that the weeds (including the nutsedge and grasses) have all dried up. They are no longer competing for moisture or nutrients. In this area all of the weeds are shallow rooted. They cannot survive because the upper layer of the soil is too dry. Only deep-rooted plants like vernonia can survive these conditions. There is a deep-rooted weed in the Mayorga planting (not seen here), a spiny amaranth that earlier could easily have been rouged out.

Seed were planted here about three weeks after the planting at CEA but this planting will be ready for harvest before the CEA planting. It is increasingly evident that drought stress is important not only in achieving desirable plant development but also in reducing time from planting to harvest.

When I visited here in November and arranged the Mayorga planting I was a little concerned that this clay loam might be too heavy for vernonia. And in February I regretted my decision for it appeared that in some areas the soil might not be deep enough. But now I conclude that we can grow vernonia on these soils under irrigation during the dry season but I strongly doubt our crop will thrive on these soils during the rainy season.

The Cesar Lanuza planting near Telica:

Seed were planted December 26-January 4. In the photos (Plate 6) I have tried to show the best and the worst. The panorama, from the north east corner of the field is the view from south (left) to west (right). There are other areas like this but this is the extreme. I suspect the poor stand is due to the excessive amount of debris from the previous sorghum crop.

The three lower photos were taken at the southeast corner of the field where we have an excellent stand. The left photo is the view to the northwest toward the irrigation pump and the center photo is a view east (note mountains in the background. The right photo shows a plant with young flowerheads. Two have the lavender florets; the others are smaller and will soon flower.

I have two concerns here. There were a fair number of white flies that carry a virus disease and leave a sticky deposit that can be troublesome at harvest time. We saw evidence of the virus on one type of weed but none on the vernonia. The sticky deposit was insignificant. We have reports that white fly is not a problem with vernonia in Belize, Guatemala, and Dominican Republic and we saw no evidence of white fly in Costa Rica. According to the report from Dominican Republic, white fly visits vernonia but does not effect the crop.

The other concern was the slight wilting of the uppermost leaves. I observed this during the heat of the day but could not get back here in early morning to see if the upper leaves had recovered and were turgid. I also observed this at the Mayorga planting during mid-day; the plants completely recovered during the night. This may be evidence of the drought stress this plant needs but I am not sure.

When I was here a month earlier I asked that there be no more irrigation until the surface soil had dried out to a depth of about 6 in. When I arrived in March they has just completed irrigating -the first since my earlier visit - 2 hours at each placement of the sprinklers - and 7 days to irrigate the entire field. What to do about further irrigation was a tough call. The nut sedge had not dried up completely as at the Mayorga planting. The plants at the southeast end of the field, where there had been no watering for 7 days appeared somewhat stressed. Not knowing what to do, I compromised and asked them to delay irrigation for another week and then water for 3 hours at each placement of the sprinklers - then no further irrigation.

Green nutsedge seems to be a good indication there is adequate moisture in the upper 6 inch of the soil. I think in time we will be able to use nutsedge as a good indicator of the need for irrigation. Once vernonia gets roots down deep we will irrigate only after the nutsedge shows

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clear evidence of drought stress.

Nutsedge is a major problem for which the best herbicide is reported to be Eradicane. This is not available in Nicaragua, but Cesar will have some sent from Costa Rica and try it.

Cesar has used an insecticide for the white fly and another insect he observed and fungicides to assure no disease problem. I suspect he is being overly conservative and that these expensive agchemicals are not needed. But better, at this stage of our knowledge, to be cautious and conservative and be sure.

Production costs at the Lanuza planting to date are $283 per manzana ($164 per acre) and this is very encouraging considering the substantial investment in labor for weeding, cost of power and labor for irrigation and the investment in insecticides and fungicides. Next season costs will be substantially lower and improve further as we learn more about weed control.

From what I have seen to date the sorghum windbreaks are not effective. We can grow vernonia here without them during the dry season. The wind is not severe but must reduce the effectiveness of overhead irrigation. For a dry season vernonia crop it will likely be advisable to establish the same tall perennial grass windbreaks used here with melons.

In the northwest corner of the Lanuza planting there is a small area where plants looked very unhealthy and many were dead two days later. My initial alarm was relieved when I learned this area was flooded by a leaking irrigation pipe. Vernonia will not tolerate wet feet.

The CEA planting at Polsotega:

Seed were planted November 22-24. This planting is shown in Plate 7. Where the planting is dense (upper photo) there are many flowerheads and there should be a very good crop. Seed set is good. No evidence of insects or disease. Occasional plants die for no apparent reason but this has been observed by all who have grown vernonia and we see this at all vernonia sites in Nicaragua.

Plants are still flowering; in the upper photo there are many flowerheads with lavender florets. There had been no irrigation here for 23 days but still abundant soil moisture. I advised them to stop irrigation completely.

Note the plant in the center of the upper photo. It is about 6 inches taller than the others. This is an odd-ball variant that we have seen before. My first reaction was that this was probably a contaminant, introduced into this population at the Chiredzi Research Station in Zimbabwe when they grew out the germplasm collection several years ago. But it has all the technical characteristics of var. ethiopica so cannot be from other germplasm as we have only one accession of this variety.

A record of irrigation at CEA (Riego de Vernonia) is attached. The total water applied was 537.6 mm (21.2 in), considerable less than I had anticipated. This compares favorably with 540 to 619 mm reported for a crop in Zimbabwe where growing season temperatures are lower and the growing season is longer.

The ACAESA farms near Leon:

We visited two ACAESA farms (Plate 8) with Johan Brun, a Dane posted here by the Danish equivalent of AID to advise this group which controls nine farms totaling 2000 hectares (1000 hectares of which are irrigated).

ACAESA is the acronym for Agricola Carlos Arguella Echeveria, S.A. and honors a Sandinista Comandante.

The upper left photo in Plate 8 shows irrigated corn growing on sandy loam; according to Rene Landgrand, this is some of the best land in Nicaragua. Note the lack of nutsedge; just one plant in this view. The same plant is shown in the lower right photo. Someone has been doing something right here.

The upper right photo shows an apparatus used for threshing sesame attached to a conventional combine. We will want to try this with vernonia, especially to see if the combine mechanism will debeard the seed.

A pivot irrigation system in the lower left photo.

When we arrived at the first farm a group was shelling corn with a sheller manufactured in Nicaragua. See notes for IMEP.

IMEP (Industrias Metalurgicas del Pueblo), Managua:

The corn sheller I saw at ACAESA is manufactured here. There are two models. The one pictured on their brochure (copy attached to this report) is designed to be used with a tractor power take-off and costs $954. The other, designed to be powered by an electric motor, costs $600 (without motor).

The principal of operation is like the corn sheller we used in Costa Rica for debearding vernonia seed before it was modified for processing vernonia. However, the shaft to which the bars are attached, is much shorter than the shaft of the Costa Rican machine (which was shorter than desirable). The IMEP machine is smaller than we require but one with dimensions to meet our requirements can be constructed here for, I suspect, under $2000. I will pursue this further during the next trip to Nicaragua.

ANSCA, near Telica:

I returned here because I wanted to examine their Clipper cleaner again in light of what I had learned from Clipper about their debearder. Clipper makes a debearder which fits on top of the cleaner, and I believe it will be effective in debearding vernonia seed. I climbed to the top of the Clipper to see if there is enough clearance to install the debearder without expensive modification. The clearance is fully adequate.

But the problem is that there will be so much trash with vernonia and, the way trash disposal is managed at ANSCA, vernonia trash will soon clog the system. My thinking now is that we will have to partially debeard the seed before they are fed into the Clipper and that this is best done with a corn sheller fabricated by IMEP to our specifications. I envision setting up a corn sheller at an isolated point on ANSCA grounds where dust and trash will not be a problem so that the debearded seed will blow crosswind into a cotton trailer. The wind will carry away most trash and dust. (If wind is not adequate we will use large fans available at ANSCA) We will then take the seed to the Clipper. One pass through the sheller may be adequate - two may be required. If two passes are required, in time we can use the sheller for the first and install another on top of the Clipper for the second pass.

Judging from our experience with debearding in Costa Rica I am confident this system will succeed, especially if we can debeard soon (within a few weeks) after harvest. Freshly harvested seed are much easier to debeard than those than have been stored for a long time.

ANSCA will provide an International 782 cotton harvester to be adapted to vacuum harvest of vernonia. We will have to pay only the cost of a new battery. They will remove the cotton picking apparatus.

I could not ask for better cooperation than that I am promised by ANSCA.

Instituto Polytechnico La Salle, Leon:

Met with Benito Muñoz, head of the machine shop, to discuss fabrication of the pick-up for the cotton harvester. Before departure for Managua, I had tried to make a sketch to illustrate what I need but without great success as I am no artist. So I made a small model with stiff boxboard and scotch tape. That served quite adequately and Benito seems to understand just what I need. The mechanism is to be ready by April 11.

With the pick-up attached to the cotton harvester this will be like a giant household vacuum cleaner. We will windrow plants, shake off the seed, lift off the plants and then vacuum seed off the ground. We will line the basket with a coarse fabric (similar to the saran we used in Costa Rica) to hold the seed but let the air pass through. If this approach proves satisfactory we will later line the basket with a more durable metal screen.

Tom Green, Winrock:

Tom is involved with Winrock's Farmer to Farmer Program, financed by USAID which

arranges for visits of volunteer consultants to developing countries. Tom was in Nicaragua to determine needs for technical advice. He had visited Patrick Bolaños who suggested it might be fruitful for me to meet with him. We had dinner together one evening at the hotel.

Tom was receptive to the need for several specialists to visit Nicaragua on vernonia related problems. One of especially pressing importance is the nutsedge problem. Tom expressed the view that this would be acceptable to his program if it were endorsed by Brian Rudert, USAID. I later discussed this with Brian and it is my understanding we will get his endorsement on this.

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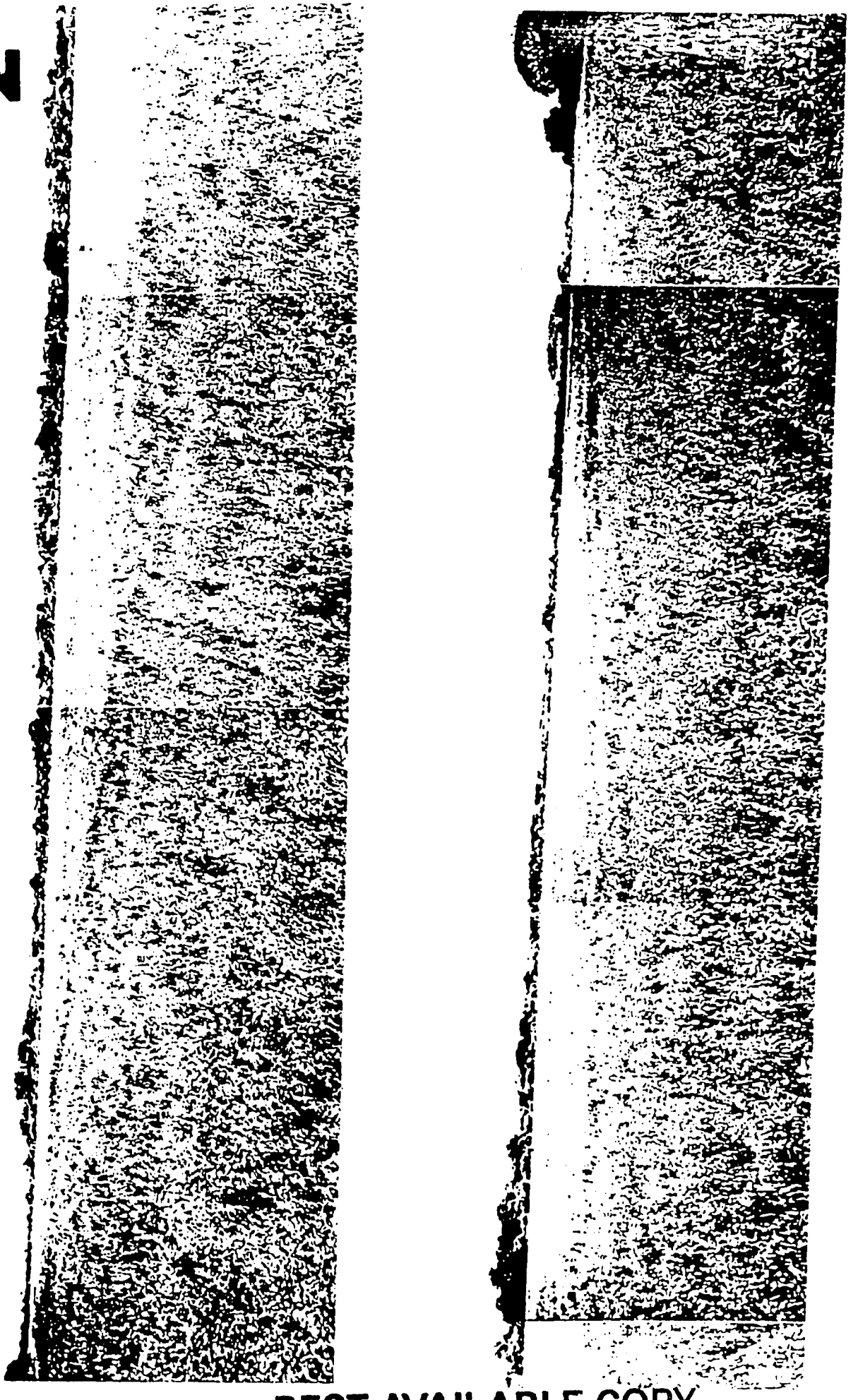

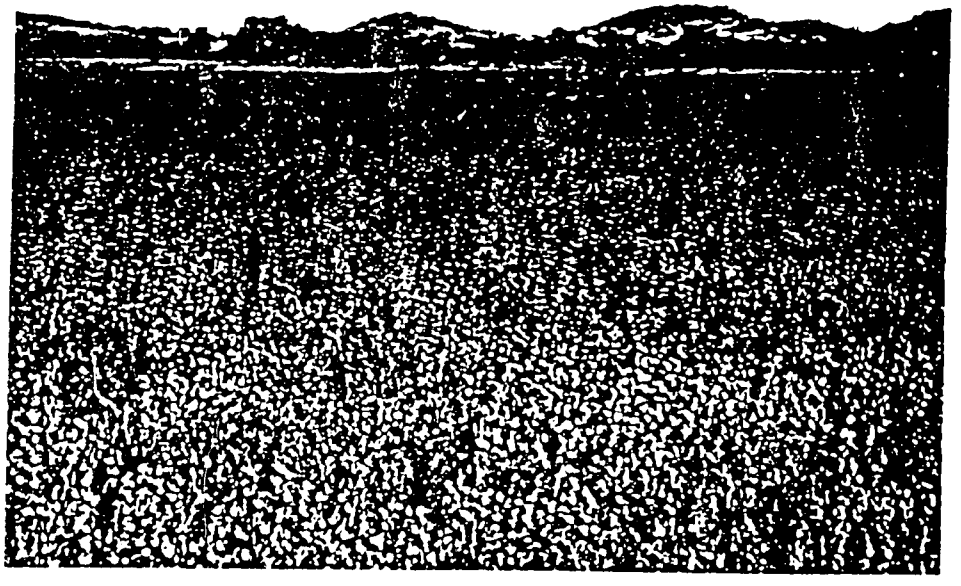

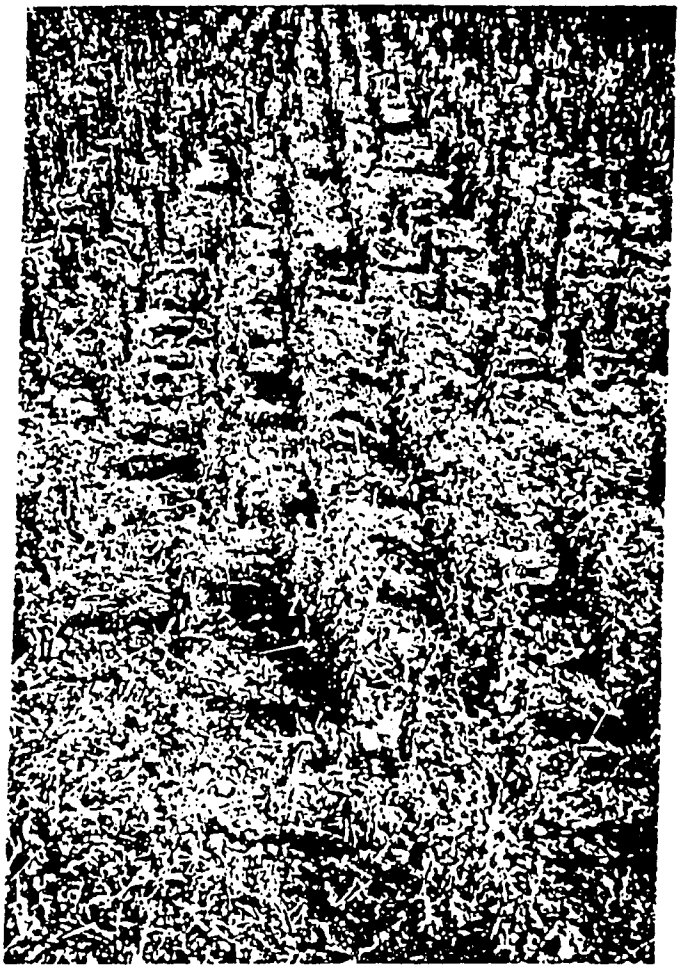

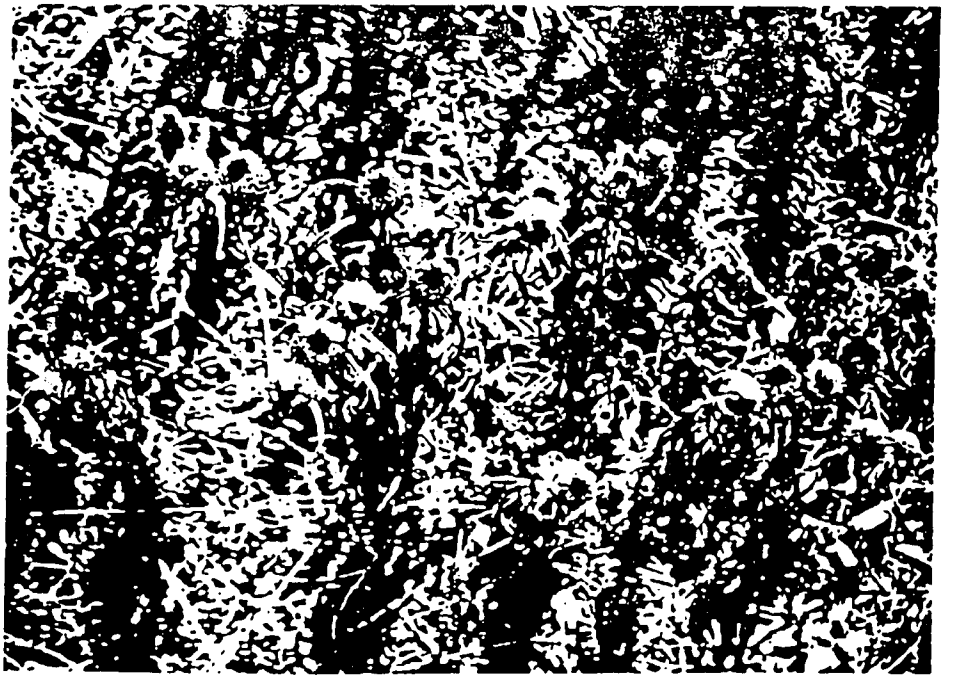

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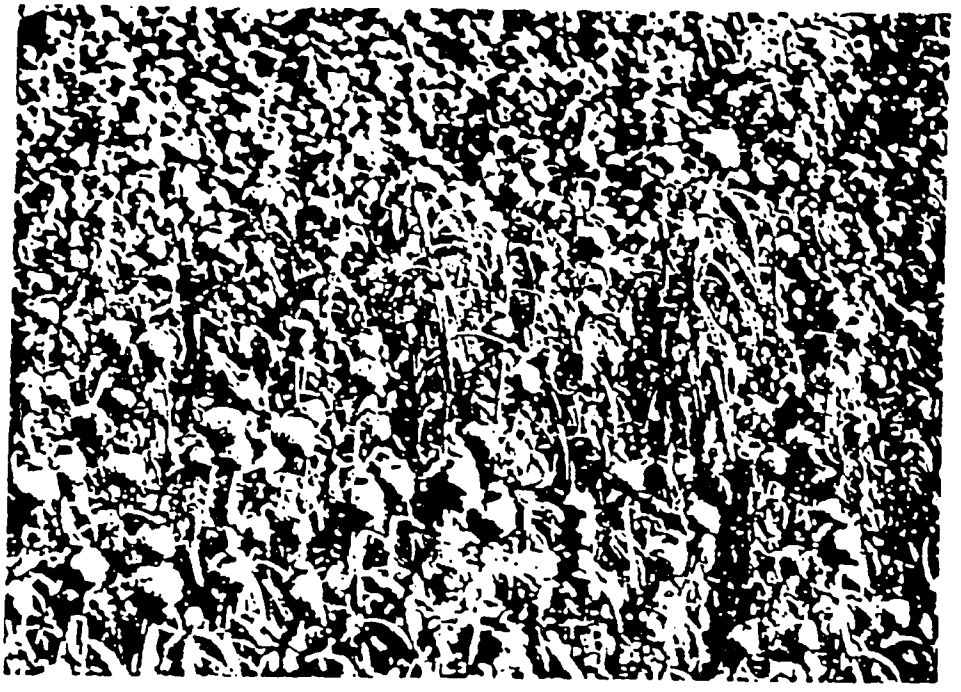

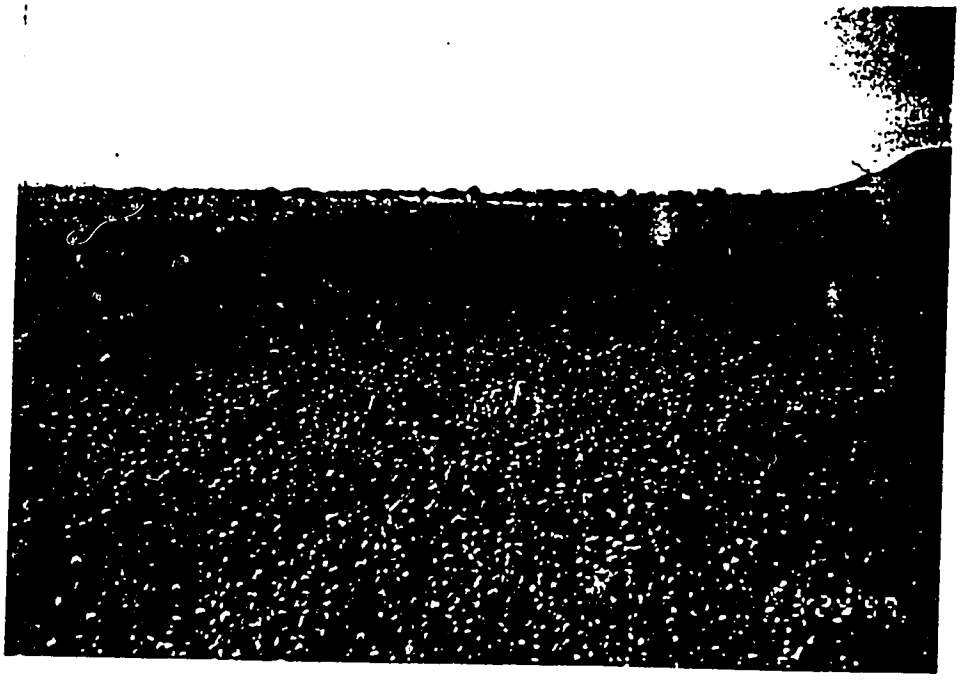

RIEGO DE VERNONIA

Antes de la siembra		
22/11/93	9 horas de riego	120.15 mm
Después de la siembra		
29/11/93	1 hora de riego	13.35 mm
13/12/93	3 horas de riego	40.05 mm
20/12/93	4 horas de riego	53.4 mm
27/12/93	3 horas de riego	40.5 mm
06/01/94	2 horas de riego	26.7 mm
12/01/94	3 horas de riego	40.5 mm
20/01/94	3 horas de riego	40.5 mm
01/02/94	3 horas de riego	40.5 mm
08/02/94	3 horas de riego	40.5 mm
18/02/94	3 horas de riego	40.5 mm
28/02/94	3 horas de riego	40.5 mm

Precipitación Total 537.6 mm

13.35 milímetros por hora.

Posoltega, 24 de Marzo de 1994.-

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