PD-AAR-281
ISN 4[illegible]

NORTH CAMEROON

LIVESTOCK AND AGRICULTURAL DEVELOPMENT

PROJECT 631-0004

AGRO-PASTORAL ANNUAL REPORT 1983

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Prepared for:

USAID/Cameroon and the

Government of the Republic of Cameroon

Contract AID/afr-C-1566

March 1985

EXPERIENCE, INCORPORATED

MINNEAPOLIS, MINNESOTA 55402

An important objective of the North Cameroon Livestock and Agriculture Development Project (Project Mindif) was to reduce the need for farmers to continually encroach on limited grazing land.

To accomplish this objective, the project has developed and is continuing to develop farming systems which combine technological advances and conservation practices to maintain the fertility and the increased productivity of existing agricultural land. Interventions are being evaluated at two levels. Proposed interventions are tested at the Mindif Center for their effectiveness. Interventions are also being evaluated through the cooperation of 30 farmers in project activity areas for their adaptability and acceptability.

The project began evaluating crops, crop varieties and cultural practices in 1980. Local sources of information and material include IRA Maroua, IRZ Ngaoundere, SODECOTON and the Seed Multiplication Project. Although most of this information was included in other reports, results from previous years are included here to provide a comprehensive documentation of the progress in evaluating these crops, varieties and cultural practices.

Mindif Center trial and observation plot results.

Peanuts:

1980:	Variety	: 28-206
	Seed Source	: Seed Multiplication Project
	Planting Date	: June 10-11
	Plant Spacing	: 36cm x 36cm
	In vitro germination	: 70%
	Plant emergence	: 30-60%
	Fertilizer	: None
	Previous Crop	: Abandoned fallow
	Harvest Date	: October 11-20
	Yield	: Peanuts (unshelled) = 273 kg/ha
		Peanut Hay = 1,860 kg/ha

Observation: The peanut variety 28-206 is recommended for the Mindif project zone. This variety is desirable because of its relatively large pods but has two major disadvantages: a long vegetative cycle (120 days) and low drought tolerance. These factors combined to produce a very poor harvest.

1981:	Variety	: 55-437
	Seed Source	: Seed Multiplication Project
	Planting Date	: June 23-24 (replant July 4-6)
	Plant Spacing	: 50cm between rows x 20cm between plants
	In vitro germination:	: 81%
	Plant emergence	: 70-75%
	Fertilization	: 100 kg/ha Complete ($15-15-15 + 6S + 1B_2O_3$)
	Previous Crop	: Sorghum - Cowpea Intercropped
	Harvest Date	: October 5-19
	Yield	: Peanuts - 1,853 kg/ha
		Peanut hay = 3,220 kg/ha

Observation: 55-437 is a Spanish variety with a vegetative cycle of 90-100 days. Major advantages include the short vegetative cycle and good drought resistance. A major disadvantage is the lack of dormancy; 70% of the peanuts will germinate in moist soil upon reaching maturity. Given the unpredictability of the rainy season over the last decade, it seems prudent to consider a short rainy season to be normal rather than exceptional in the Mindif project zone. This being the case, a short-cycle variety such as 55-437 seems better adapted to the region than longer-cycle varieties. However, the lack of dormancy in 55-437 does not make it a wise choice if the rainy season extends into mid-October because the situation forces a farmer to take time off from his mousquari fields to harvest his peanuts as soon as they reach maturity. Therefore, other short-cycle varieties which have dormancy would be more appropriate. An additional nine varieties were collected from IRA Maroua and the United States Department of Agriculture Germplasm Resources Laboratory. These varieties were evaluated in a randomized, complete block trial with three replications.

Variety	Source	Yield/ha
1. Starr	U.S.	1,860
2. 55-437	Seed Project	1,660
3. Pronto	U.S.	1,550
4. Argentine	U.S.	1,410
5. 73-33	IRA	1,360
6. 73-30	IRA	1,330
7. Spancross	U.S.	1,310
8. 48-125A	IRA	1,230
9. 28-206	U.S.	1,080
10. Valencia	U.S.	1,030

Observation: The 55-437 variety gave the highest yield of all the varieties available locally, but the results suggest that more productive short-cycle varieties exist.

1982:	Variety	: 55-327
	Seed Source	: Seed Multiplication Project
	Planting Date	: June 25 (replant July 19)
	Plant Spacing	: 50cm between rows x 15cm between plants
	In vitro germination	: 89%
	Plant emergence	: 70-75%
	Fertilizer	: 100 kg/ha Triple Superphosphate (45/46% P_2O_5)
	Previous Crop	: Sown fallow (Stylosanthes guyanensis Var. FAO 46-004)
	Harvest Date	: October 11-13
	Yield	: Peanuts (fertilized) = 2,224 kg/ha Peanuts (not fertilized) = 2,232 kg/ha Hay = 4,408 kg/ha

Observation: A 100 m^2 check plot was left unfertilized to observe the effects of phsophate fertilizer. No significant yield difference was noted. The variety tried was also repeated in 1982.

Variety:	Yield/ha
1. Starr	2,222
2. 55-437	2,444
3. Pronto	2,925
4. Argentine	2,370
5. 73-33	1,592
6. 73-30	1,741
7. Spancross	2,481
8. 48-125A	2,074
9. 28-206	1,963
10. Valencia	1,963

1983:	
Variety	: 55-437 (surface area - 9,200m^2)
Seed Source	: Seed Project
Planting Date	: June 25-27
Plant Spacing	: 50cm between rows x 15cm between plants
In vitro germination	: 80%
Plant emergence	: 65-75%
Fertilizer	: 100 kg/ha Complete (15-15-15 + 6S + $1B_2O_3$)
Previous Crop	: Seeded fallow (Stylosanthes guyanensis Var: Cook)
Harvest Date	: October 3-22
Yield	: Peanuts (fertilized) = 1,575 kg/ha Peanuts (not fertilized) = 1,150 kg/ha Hay (fertilized) = 3,080 kg/ha Hay (not fertilized) 2,400 kg/ha

Observation:

The total amount and the distribution of rainfall in 1983 was the worst since the beginning of the project.

Because no significant yield response to triple super phosphate was demonstrated in 1982, complete fertilizer was used.

The cost effectiveness of this fertilizer was shown at Mindif and in 77% of the collaborating farmer's fields.

The advantage of using complete fertilizer, particularly in a short rainy season, is the acceleration in the early growth stages promoted by the nitrogen.

Plots which were not fertilized also exhibited signs of nitrogen deficiency in the later growth stages. Fertilizer response is being studied by Dr. Schilling at IRA.

Until other fertilizer rates are shown to be effective, the project will continue to recommend complete fertilizer for general use.

The best varieties from previous trials at Mindif and the three promising varieties obtained from Dr. Schilling at IRA were grown in observation plots.

Variety	Yield/ha				Weight of 100 Pods	% mature seed
	With Fertilizer		Without Fertilizer			
	Peanuts	Hay	Peanuts	Hay		
1. K 1853	1,560	3,024			70.8 g	50%
2. K 3277	1,280	2,724			77.5 g	25%
3. K 3287	1,232	1,152			81.6 g	30%
4. Pronto	700	712			45.0 g	38%
5. 55-437	1,288	2,324	980	2,200	64.0 g	54%
6. Spancross	1,384	2,432	1,200	1,800	67.0 g	48%
7. Starr	1,108	2,464	1,160	2,000	65.0 g	30%
8. Argentine	1,464	3,364	1,280	3,000	61.0 g	46%

Observations:

The cultivation of all food and fiber crops, except for controlled studies, is done by local farmers under project staff supervision. These observation plots were grown as follows: One cooperating farmer was responsible for the first four varieties and another cooperating farmer was responsible for the last four. The first four varieties were all fertilized so that no fertilizer use evaluation was made. The Pronto variety was only weeded once and, therefore, cannot be compared with the other varieties which were weeded twice. It appears that there are several varieties which could replace 55-437 for general use.

The project plans to continue to evaluate promising varieties; however, the general recommendations for the project area will continue to be 55-437 until Dr. Schilling has evaluated other varieties under perfectly controlled conditions. Promising varieties will then be evaluated under actual farm conditions by the project's cooperating farmers.

Cowpeas

1980: The North Cameroon Livestock and Agricultural Development Project began evaluating the potential for cowpea production in the project zone by participating in the Semi-Arid Regional Cowpea Adaptation Testing in cooperation with Mr. Gwathmey and Mr. Fobasso from the SAFGRAD project, located at IRA, Maroua.

Varieties retained from this testing and their test yields are listed below.

Variety	Test Yield
1 Kpodiguegue	1,875 kg/ha
7 58-57	1,583 kg/ha
14 TVx 1948-01F	1,854 kg/ha
18 KN-1	1,562 kg/ha
12 TVx 1990-01F	1,542 kg/ha
16 Vita 5	1,171 kg/ha

Observations:

Evaluation of cowpea varieties has been continued in trials at the Mindif Project Center and in the fields of the collaborating farmers. By 1983, three varieties had been eliminated for the reasons listed below:

Variety	Reason for elimination
1. Kpodiguegue	Unacceptable color
2. 58-57	Susceptible to foliar diseases
3. KN-1	Storage problems

1983 Mindif Center

Three cowpea varieties were planted on one-third of the section in the rotation devoted to leguminous food crops. The preceeding crop was a planted fallow (Stylosanthes guyanensis Var. Cook). Complete fertilizer (15-15-15 + 6S + $1B_2O_3$) was applied at a rate of 100 kg/ha.

A supply of large seeded Vita 5 was provided by Mr. Moffi Ta Ama from the CRISP project at IRA, Maroua. This seed was planted outside of the rotation fields on land previously sown with Andropogon gayanus.

Variety	Planting Date	Area	Seed Yield (kg/ha)		Hay Yd.(kg/ha)	
			Fert.	Not Fert.	Fert.	Not Fer
TVx 3236-01G	June 30	1,110m^2	739	730	1,033	700
TVx 1948-01F	June 30	1,110m^2	571	260(not weeded)	1,700	950
Vita 5	June 30	1,110m^2	787	650	1,730	800
Vita 5 (large seed)	July 6	4,656m^2	672	560	1,100	600

Observation:

The limiting factor in production in 1984 was moisture. The number of days from planting until 50% of the plants produced their flowers was determined to be 57 days for all three varieties. During the following 18-day period, a mere 14.9 mm of rain fell at Mindif Center. While the pods were filling, plants were already under severe drought stress.

Intercropping

Since 1981, the Mindif Project has evaluated cropping systems which could increase unit area production. An intercropping system was tested using improved sorghum and cowpea varieties. Sorghum and cowpea were planted alternately in the same row at a spacing of 45 cm between plants. This system has several disadvantages. Improved cowpea varieties suffered from the shading effect of the sorghum. Improved cowpea varieties require insect protection to produce appreciable yields. The reduced plant density required more insecticide to be used and treatment became difficult as the sorghum grew taller.

In 1983, a band intercropping system was evaluated. This system consists of alternate bands of four rows of sorghum and three rows of cowpeas.

Two sorghum varieties (SPV-35, E35-1) and two cowpea varieties (TVx 3236-01G, TVx 1948-01F) were compared in monocrop and intercropping situations.

The results are given below:

Variety		Yield/ha		Cowpea	Sorghum
Sorghum	Cowpea	Sorghum	Cowpea	Hay	Stalks
1. SPV-35		2,644 kg			4,132 kg/h
2. E 35-1		2,236 kg			8,680 kg/h
3.	TVx 1948-01F		1,328 kg	1,912 kg/ha	
4.	TVx 3236-01G		1,372 kg	1,576 kg/ha	
5. SPV-35	TVx 1948-01F	1,948 kg	544 kg	448 kg/ha	2,568 kg/h
6. SPV-35	TVx 3236-01G	2,088 kg	624 kg	500 kg/ha	
7. E 35-1	TVx 1948-01F	1,592 kg	688 kg	540 kg/ha	5,276 kg/h
8. E 35-1	TVx 3236-01G	1,760 kg	644 kg	500 kg/ha	

Observations:

The trial indicates that band intercropping can increase the value of agricultural production over a monoculture sorghum crop without greatly reducing sorghum yields.

The intercorpping system is slightly more difficult to plant but both crops can be planted at the same time.

The three-row bands of cowpeas are covered by one pass of the ULV sprayer, making the treatment simple and efficient. Fewer insect problems were encountered in the band intercropping system than in monoculture cowpea fields.

Cotton

Because it is the major cash crop grown in the Mindif project zone, cotton is included in the rotation farming system development. The cultural practices developed by SODECOTON are followed. The project was particularly interested in the effects which cultivation of letuminous food crops has on the cotton crop which follows.

Year	Previous Crop	Planting Date	Cotton Yield/ha	Annual Rainfall	Days of Rain
1981	Abandoned fallow	June 24,25	717	580 mm	47
1982	Peanuts	June 26,28	1,683	778 mm	50
1983	Peanuts	July 1,3	366	496 mm	38

Observations:

Cotton production, with its relatively long life cycle, has been directly dependent on the amount and distribution of rainfall in the project zone.

Soil fertility effects could not be determined.

Sorghum

Sorghum trials at Mindif Center have been concerned with two main factors affecting sorghum production potential: adapted varieties and cost effective fertilizer use.

The Mindif project participated in the evaluation of advanced sorghum varieties in cooperation with SAFGRAD, IRA in 1981 and 1982.

Yield results are listed in the following table:

Advanced Sorghum Variety Trial Yield Results

	Yield/ha			
	1981		1982	
Variety	Trial	Coop. Farmers	Trial	Coop. Farmers
1. E 35-1	1,970	1,900	2,917	1,839
2. C 151-186	2,410	1,320	2,442	1,360
3. 38-3	1,360	952	3,067	
4. SPV-35	2,320	2,000	3,021	1,933
5. 940-S	1,920		2,685	
6. 193-2	1,830	768	2,280	
7. CE 99	1,180	856	2,049	

(Only three varieties were distributed to the cooperating farmers in 1982.)

The three highest yielding varieties from the 1981 trials were used in a fertilizer trial in 1982 with 9 replications using 3 fertilizer rates which were: no fertilizer following cotton; 100 kg/ha complete (15-15-15 + 6S + $1B_2O_3$); and 100 kg complete fertilizer + 50 kg/ha urea (46%).

Fertilizer Response Trial Results

	Variety E 35-1		Variety SPV-35	
Treatment	Yield/ha	Yield Δ /ha	Yield/ha	Yield Δ /ha
1. Control	1,653.8 kg		2,320.8 kg	
2. Complete	1,634.5 kg	-19.3	2,616.9 kg	296.1
3. Complete + Urea	2,346.6 kg	692.8	3,329.0 kg	1,008.2

	Variety C 151-186	
Treatment	Yield/ha	Yield Δ /ha
1. Control	1,263.4 kg	
2. Complete	1,928.3 kg	664.9
3. Complete + Urea	2,441.0 kg	1,177.6

Observation:

In 1982, soil moisture was not a severely limiting factor so that application of chemical fertilizer increased sorghum production substantially. The cost of the complete fertilizer was 10,000 CFA/ha (the equivalent of 200 kg of sorghum at 50 francs CFA/kg).

The cost of the Complete + Urea fertilizer was 12,000 CFA/ha (the equivalent of 240 kg of sorghum). The trial indicates that complete + urea fertilizer can be used cost effectively on these varieties when soil moisture is not a limiting factor.

In 1983, the cost of urea (46%) fertilizer provided by SODECOTON was more or less equivalent to the price of complete fertilizer (complete at 109 CFA/kg, urea at 118 CFA/kg). Based on the results from 1982, another fertilizer trial was established.

Objectives of fertilizer response trial:

1. Examine the most effective combination of 150 fertilizer units.

2. Compare fertilizer response of two promising improved varieties with different maturity cycles; SPV-35 (90-100 days), E 35-1 (100-120 days).

3. Compare fertilizer response of improved varieties with a local variety.

Treatment and Input Costs

Treatment	Fertilizer kg/ha		Input Cost/ha			Sorghum Equiv. (50 CFA/kg)
	Complete	Urea	Complete (109/kg)	Urea (118/kg)	Total	
1	0 kg/ha	0 kg/ha	0	0	0	0 kg
2	0 kg/ha	150 kg/ha	0	17,700	17,700	354
3	50 kg/ha	100 kg/ha	5,450	11,800	17,250	345
4	100 kg/ha	50 kg/ha	10,900	5,900	16,800	336
5	150 kg/ha	0 kg/ha	16,350	0	16,350	327

Results:

Variety:	Local (red,120 days)		SPV-35 (90-100 days)		E 35-1 (100-120 days)	
Treatment	Yield/ha	Yield Δ/ha	Yield/ha	Yield Δ/ha	Yield/ha	Yield Δ/ha
1	3027.3		3164.0		2756.0	
2	3834.4	807.1	3710.9	546.9	2659.7	-96.3
3	4517.6	1490.3	4082.0	918.0	2746.8	- 9.2
4	3301.6	274.3	4446.1	1282.1	3203.1	447.1
5	3391.4	364.1	3228.9	64.9	2096.1	-659.9

Observations:

Registered rainfall at Mindif in 1983 was 495.7 mm; the least recorded over the last ten years. Because the soil moisture level became a limiting factor during the grain filling period for the long cycle varieties, fertilizer response was reduced. As the total nitrogen in the treatment was reduced, fertilizer response was signigicantly reduced in the long cycle varieties.

The fertilizer response was poor when treatment 5 was used, demonstrating the high levels of potassium and phosphorous which are required for sorghum production. Dose 4 which was used in the 1982 trials gave the best response for both improved varieties in 1983. This fertilizer dose resulted in a net loss when applied to the local variety.

Fallow

An attempt was made to establish *Stylosanthes hamata* Var; Verano as a leguminous fallow cover crop. This stylo variety had been successfully established in observation plots in 1982 and produced seed. Regrowth was also observed in 1983.

Leguminous fallow species: *Stylosanthes hamata*

Variety	: Verano
Seed Source	: Arthur Yates & Co. PTY LTD Australia
Planting Date	: July 5-7, July 25, July 30
Plant Spacing	: Banded in rows, 80 cm between rows, 10 kg/ha
In vitro germination	: 50%
Plant emergence	: 10% 20% 15%

Observations:

Although hamata is not one of the hard-seeded stylo species, it does require relatively moist soil conditions over several days for successful establishment. The first seeding was washed out by a 74 mm rain three days after planting. Subsequent reseeding was only marginally successful because of sporadic rainfall. Plants which were established from the first seeding were able to compete successfully with less desirable species but those established later suffered from the late start. Lack of significant rainfall from August 25 to September 13 resulted in poor flowering and only scattered seed formation. No seed was collected.

Cooperating Farmers

The project considers the program of examining technical interventions in cooperation with farmers in the pilot zone to be the most effective means of evaluating whether these interventions can be adapted to serve the needs of the average farmer. Many of these technical interventions do not require a fifteen-year controlled study to prove their effectiveness in conserving existing agricultural land and increasing production. But the acceptance of more productive crop varieties and the cultural practices required to make these varieties more productive can only be evaluated by farmers. Success or failure is evaluated at the end of the research chain by the former who decides that the variety, cultural practice or farming system intervention is worth his time and effort.

Peanut production:

Nineteen cooperators grew the variety 55-437. Their yields were compared with fourteen neighbors using local varieties.

Variety	Cooperating Farmers	Area	Pod yield		Hay Yield	
			fert.	not fert.	fert.	not fert.
55-437	19	5.25 ha	1,534 kg/ha	1,247 kg/ha	2,372 kg/ha	2,004
local	14	2.75 ha		789 kg/ha		1,585

Observations:

The 1983 growing season produced all of the weather conditions for which the 55-437 variety is best suited. The growing season was short with a drought period near the end of the season. Peanut stands were well established in 88% of the cooperator's fields. Fields observed during the drought stress period were in fair to good condition. The lowest yield reported by a cooperator was 192 kg/ha. Major factors included poor seeding, worn-out soil and very low field maintenance. The highest yield reported by a cooperator was 2,832 kg/ha. Major factors included good plant density,good soil structure, the use of organic and chemical fertilizer and high field maintenance.

Ten of the cooperators reported growing peanuts as a major crop before working with the project. Only four reported planting them in rows. No farmer reported fertilizing his peanuts with chemical or organic fertilizer. 62% were aware of the need to rotate peanut cultivation. Two farmers reported that their peanuts suffered from insect damage. All farmers noted the early maturity of 55-437 over local varieties. The taste of 55-437 was acceptable to all farmers who grew it. 35% reported that they hired help to harvest their crop. 27% reported that their wives and children harvested the peanuts while they prepared mousquari fields. 77% of the 18 fields in which a comparison between fertilized (100 kg/ha Complete) and unfertilized peanuts were examined showed cost effective results for the use of quality seed and fertilizer. Only 50% ofthe farmers reported stocking their peanut hay. Poor rains at the end of the season were cited as the major cause.

Cowpea Production

Variety	Cooperators	Area	Cowpea Yield Fert.	Not Fert.
TVx 3236-01G	6	1.375 ha	1,416 kg/ha	1,414 kg/ha
TVx 1948-01F	8	1.875 ha	1,307 kg/ha	1,218 kg/ha
Vita 5	3	0.625 ha	1,345 kg/ha	1,357 kg/ha
Local	1	0.125 ha	644 kg/ha	

Variety	Cooperators	Area	Hay Yield Fert.	Not Fert.
TVx 3236-01G	6	1.375 ha	2,220 kg/ha	1,548 kg/ha
TVx 1948-01F	8	1.875 ha	2,288 kg/ha	1,608 kg/ha
Vita 5	3	0.625 ha	3,320 kg/ha	2,636 kg/ha
Local	1	0.125 ha	532 kg/ha	

Observations:

The yield averages taken from all fields show little or no fertilizer effects. In fields where fertilizer comparisons were made, use of complete fertilizer (100 kg/ha) was cost effective in 7 out of 13 fields. Because drought stress was very high during the pod filling period, poor fertilizer response was expected.

Cooperators' yields ranged from 364 kg/ha to 2,096 kg/ha. Several neighboring farmers had planned to grow local cowpeas for comparison; but, with early termination of the rainy season, only one field was established with an estimated yield of 684 kg/ha. Only two cooperators reported growing cowpeas as a major crop before working with the project. 68% said that cowpeas were easier to grow than peanuts but 74% reported a preference for growing peanuts. Eleven farmers planted local cowpeas late in the season and reported heavy insect attacks. Four farmers growing improved varieties reported insect problems. A cowpea protection program was set up to protect improved varieties. During the season this program had to be adjusted so that spraying coincided with cotton spraying to prevent insect imgration.

Sorghum Production:

Variety	Coop. Farmers	Area	Grain Yield kg/ha Complete + Urea	Complete	Not Fert.
E35	11	2.75ha	2,124	2,124	1,446
SPV-35	7	1.75ha	2,259	1,892	1,406
Local (red)	2	0.50ha	1,924	1,244	1,496
Baidai	2	0.75ha			1,124

Variety	Coop. Farmers	Area	Stalk Yield kg/ha Complete + Urea	Complete	Not Fert.
E 35	11	2.75ha	4,799	4,262	3,474
SPV-35	7	1.75ha	3,794		2,337
Local (red)	2	0.50ha	3,456		3,453

Observations:

The average yield in neighboring local (red) sorghum fields was 2,056 kg/ha on manured fields and 1,533 kg/ha on non-fertilized fields. Sorghum stalk weight was 3,142 kg/ha.

In the eight cooperators' fields where fertilizer comparisons were made, the combination of 100 kg/ha complete fertilizer applied at first weeding and 50 kg/ha urea applied at second weeding was cost effective in each case. Average yield increases were 773 kg/ha for SPV-35 and 665 kg/ha for E35-1.

Two farmers reported insect attacks on the E35-1 variety during early growth stages. One of these farmers was tardy and removed the previous year's cotton stalks just prior to planting. Three farmers reported that their SPV-35 fields were damaged by birds because of the early grain production.

Prior to working with the project, seventeen cooperators grew sorghum as a major crop. Only three planted sorghum in rows. Nine reported having used manure on sorghum. One farmer reported having used chemical fertilizer. 55% of the cooperators believed that sorghum could be grown on the same land for more than one year. 28% believed that sorghum could be grown on the same land for five or more years successively.

Millet Production:

Variety	Coop.Farmers	Fert. (50 kg/ha Urea)	Not fert.	Neighboring Fields (4)
Local	10	1,564 kg/ha	1,161 kg/ha	1,151 kg/ha

Observations:

Although the project grew observation plots of three research-developed varieties of millet in 1981 (Souna-3, Mouri-79 and a Nigerian Composite), yields were much lower than those of local varieties An application of 50 kg/ha or Urea 46% was found to produce dramatic yield increases when applied to local varieties.

Urea application in eight out of nine farmers' fields, where fertilizer comparisons were made, proved cost effective. The average yield increase was 407 kg/ha. Most farmers reported lower than normal production because of moisture stress. 93% of cooperating farmers reported growing millet as a major crop. 31% reported using organic fertilizer on millet. 6% reported using chemical fertilizer. 70% of the farmers said that millet could be grown on the same land for more than one year. 45% said this could be done for three years or more.

Cotton production:

Twenty-eight cooperators grew cotton. The average surface area was 0.52 ha. Yields averaged 940 kg/ha producing an average revenue of 45,749 francs CFA.

Fallow productions:

Cooperators were provided with two forage species to establish their fallow in rotation (*Stylosanthes guyanensis* and *Andropogon guyanus*). The Cook variety of stylo was planted as a leguminous fallow crop in Mindif Center in 1982. Forage production was estimated at 2,180 kg/ha on 0.5 ha with 40% ground cover.

Andropogon proved to be an easily established, productive forage species over the last three years of reseeding trials.

Eash cooperator set aside some fallow land. The average fallow was 0.54 ha. Seeded fallow was successfully established by five of the cooperating farmers. Eleven of the farmers waited until August to seed their fallow ground. The others did not plant any fallow crop because of the unfavorable rainy season.

Observations:

The basic farming system which exists in the project zone has developed over the years as a natural system for survival. The major principle is "when it rains, plant something." This principle takes precedence until the farmer is forced to devote his time to the maintenance of the crops which he has established. There is an order of priority given to each culture based on its value, growing cycle and the rain pattern. Because of land use pressure, the project has been given the task of trying to keep agricultural lands productive. If the soil nutrient level is maintained by cyclical farming and cost effective chemical fertilizer use, the major constraint against maintaining soil productivity is the breakdown of soil structure.

Crop rotation, which includes a period of well-established fallow, is essential to rebuild soil structure after continuous cropping. Andropogon planted on fallow ground produces a high level of sub-soil organic matter necessary to build soil structure for better aeration and water penetration.

It is difficult for a farmer to devote his limited efforts to cultural practices which do not have immediate effects. 79% of the collaborators practiced some form of rotation before they started working with that project. When questioned further, this rotation usually consisted of making sure that cotton was not grown on the same land two years in a row. Only 17% of the collaborators said that they had included any type of fallow in their farming system.