Summary of JAICAF -INRAB Cooperative NERICA Trials, the Wet Season, 2007, in Benin

JAICAF and INRAB (National Agricultural Research Institute of Benin) conducted a series of cooperative trials of upland and lowland NERICA varieties in the wet season of 2007. The results indicated various issues relating to ways of dissemination and realizing the Green Revolution in African countries.

Locations of the trials: The following five locations were selected to conduct upland NERICA trials, and out of these, three locations conducted lowland NERICA trials in separate places.

1. Dangbo, Ouémé Department - Upland NERICAs
2. Covè, Zou Department - Upland NERICAs
3. Glazoué, Collines Department - Upland and Lowland NERICAs
4. Bagou, Alibori Department - Upland and Lowland NERICAs
5. Cobly, Atacora Department - Upland and Lowland NERICAs

At the sites Dangbo and Covè, lowland NERICA trials were conducted in the off season (December 2007 - March 2008). Data are to be reported later.

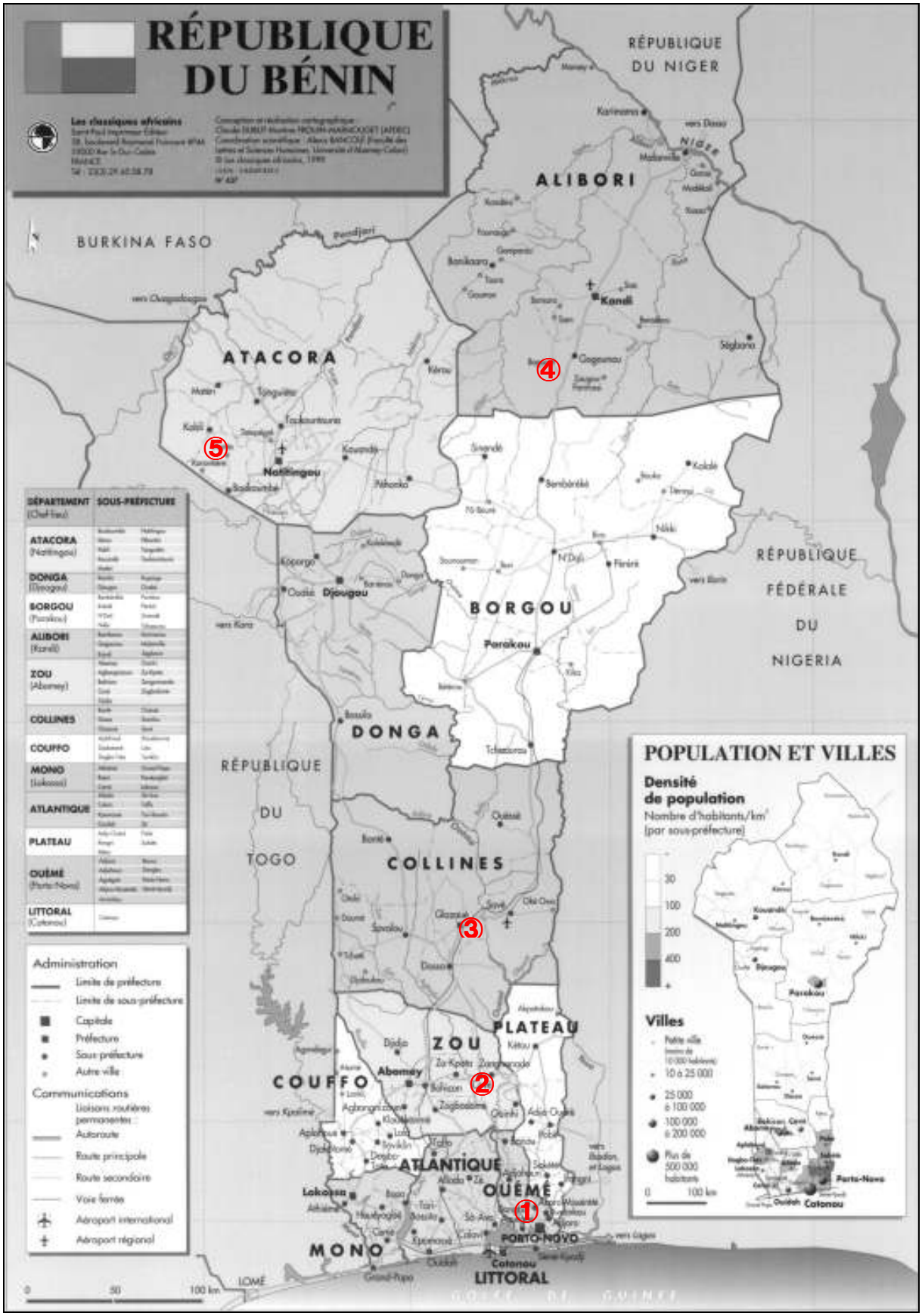
Varieties tested: Four varieties each for upland and lowland NERICA were tested with one local check variety. Upland rice varieties were N-1, N-2, N-4, N-6, and lowland rice varieties were N-L14, N-L20, N-L26, N-L28 (denoted in Table 2 as V14, V20, V26 and V28). The lowland NERICA varieties were leading varieties selected by farmers in 2006 PVS-R (Participatory Varietal Selection for Research). The check varieties were commonly used in all the locations; INARIS 88 for upland rice, and WITA 4 for lowland rice.

Design of the trials: The same design of the trials was applied in all locations: five varieties with three replications, the plot size of 5 x 3 meter (planting space of 10 cm x 30 cm) with 10 rows of 50 hills each. Each plot was surrounded by empty spaces of one meter. The plot allocation of upland and lowland rice was independently decided using RCBD (Randomized complete block design), but the same arrangement system was adopted in different locations for upland and lowland groups.

Methods of cultivation: For upland rice, 200 kg/ha of composite fertilizer (14N:23P:14K:5S:1B) was applied as basal fertilizers on the day of leveling, and direct-seeded hills were later adjusted to three seedlings per hill. For lowland rice, the amount of fertilizers was the same as for upland rice, and three seedlings per hill were transplanted (the age of seedlings was not indicated). For both of upland and lowland, urea (N 46%) was top dressed at the rate of 150 g per plot after weeding, around six weeks after seeding, and after draining water in case of the lowland trials. Weeding was conducted two to three times.

Items recorded:

1. Crops in the field in the past three seasons
2. Dates of seeding, 50 % germination, and weeding
3. Days to 50 % and full heading



①Dangbo ②Covè ③Glazoué ④Bagou ⑤Cobly

Locations of the trials

4. Number of tillers on 60 days after seeding, and plant height at maturity
5. Number of off-type plants per plot
6. Number of panicles per 1 m^2, spikelets per panicle, and percentage of fertile grains
7. Weight of 1,000 fertile grains, and *yield at 14 % moisture*
8. *Diseases, insect pests*, precipitation, *temperatures*

Results from trial sites generally did not report above item in italic, and instead the grain weights (total, fertilized and empty) obtained from three 5 m rows were reported. Therefore these data were used to calculate rough estimation of yields per unit area.

Results

1) Upland NERICAs

Out of five trial sites, at Dangbo, low rainfall after seeding caused very poor germination and plant establishment, and variation of plant growth among plots was notable. Data were reported as shown in Table 1, but due to many missing hills and lack of data from one or two replications (shown with *), the information from Dangbo should be considered only for reference.

At Bagou, germination and plant establishment was normal up to tillering stage. After the heading stage, no rainfall and sandy soil of the field led to induce severe wilting of rice plants. Therefore, data were obtained only for tiller count at 60 days after seeding. The precipitation was observed and recorded well using a simple pluviometer.

At Covè and Glazoué, plant establishment and growth was normal. However, rodents from nearby bushes severely attacked causing crop losses, roughly estimated as much as 50 % at Cové. At Glazoué, heavy rainfall forced to reseed the trial three weeks later, moving the first seeded plants to another field, and growth of transplanted upland rice seemed quite attractive. This suggested a countermeasure for the peril of drought which is becoming rather common in upland rice cultivation in recent years in African countries.

At Cobly, missing hills and rodent damage was not observed, but delay of top dressing which was applied almost at the start of heading seemed to cause lower number of tillers. Moreover, no rainfall at the maturing period caused poorer grain filling and smaller 1,000 grain weight, thus leading to low yield in spite of rather favorable crop stands in the field at the heading stage, when JAICAF team visited (Table 1).

Table 1. Performance of five upland rice varieties at five locations

Site of trial (Latitude, North)	Variety	Hills per Row	Tiller per Hill	Days to First Heading	Panicle Count	Grains per Panicle	Yield per 3 Rows (kg)	1,000-grains Weight (g)	Yield Estimate (t//ha)
Dangbo	Nerica-1	31.8	5.8	75.3	24	95 *	28 *	26 *	0.07*
	Nerica-2	19.9	4.0	78 *	25 *	95 *	60 *	25 *	0.14*
	Nerica-4	31.8	3.3	68.0	35 *	72 *	42 *	27 *	0.09*
	Nerica-6	32.0	5.5	71.7	33	143.2	69.3	29.6	0.15
	INARIS	23.9	7.5	84 *	–	–	–	–	–

Covè	Nerica-1	28.6	7.9	59.3	63.0	155.8	386.3	31.8	0.86
	Nerica-2	29.5	6.5	59.0	67.7	132.1	379.3	29.8	0.84
	Nerica-4	16.9	5.9	60.7	67.0	150.6	310.2	30.2	0.69
	Nerica-6	30.2	5.5	59.0	65.7	150.0	239.7	31.5	0.54
	INARIS	26.5	11.9	64.0	99.3	182.3	527.7	27.3	1.17
Glazoué (7° 55'50")	Nerica-1	47.2	11.8	60.7	68.3	249.3	1258.7	29.0	2.80
	Nerica-2	43.0	13/6	56.7	61.3	211.3	1106.3	27.3	2.48
	Nerica-4	46.7	14.6	61.3	71.0	241.0	1353.2	28.8	3.01
	Nerica-6	48.3	13.4	62.7	67.7	239.9	663.3	24.7	1.48
	INARIS	50.0	13.3	65.3	89.0	291.7	628.0	23.9	1.39
Bagou (10° 44'57")	Nerica-1	33.7	6.1	−	−	−	−	−	−
	Nerica-2	32.0	5.9	−	−	−	−	−	−
	Nerica-4	34.3	5.0	−	−	−	−	−	−
	Nerica-6	34.7	5.8	−	−	−	−	−	−
	INARIS	43.7	9.2	−	−	−	−	−	−
Cobly (10° 28'52")	Nerica-1	42.2	4.0	61.0	56.7	103.1	203.6	25.1	0.45
	Nerica-2	48.2	4.5	55.0	59.7	92.4	240.1	23,7	0.53
	Nerica-4	42.9	5.0	59.3	75.7	116.0	243.7	24.7	0.54
	Nerica-6	48.5	3.8	65.0	78.7	114.2	158.6	25.3	0.35
	INARIS	45.1	4.2	70.3	103.0	127.6	17.0	22.3	0.04

Note: Data with * in Dangbo are those from only one or two replications.

Dangbo: Poor establishment due to little rainfall, and great variation of plant growth among plots.

Covè: Good soil conditions, but severe damage by rodents from bushes.

Glazoué : Good establishment and plant growth, but damages by rodents were observed

Bagou: No rainfall after heading stage, and due to poor soil quality, no hope to survive to maturity.

Cobly : NERICA varieties are to be harvested two days later, but the plot of INARISS with a red tag (right) cannot reach to maturity

2) Lowland NERICAs

Out of three locations, at Bagou, the field was attacked by the flood at three weeks after planting. While nearby farmers had to give up the cultivation, the trial field did not indicate so many missing hills. However, the rainy season ended before entering 50 % heading. Though the soil was much clayey compared to the upland NERICA field, the crop could not reach to maturity, and no data was obtained.

At Glazoué, many missing hills due to heavy rainfall forced to set up a new testing field two weeks later. This might be a reason of lower number of hills per row and panicle counts, but higher grain fertility and heavier 1,000 grain weight compared to those at Cobly resulted in higher yield. The difference of yields was clearer especially in later varieties, WITA 4 and N-L28. WITA 4 produced 5.4 t/ha in the replication 1.

At Cobly, establishment and plant growth looked quite good at the 50 % heading when JAICAF team visited the field. However, it was feared that the rainfall might not be further expected. The number of panicles per unit area was much more at Cobly than at Glazoué, but the panicle weight, weight of fertilized grains, and 1,000 grain weight were inferior. From the record of field management, it was found that, on 25 days after seeding,

the second weeding was conducted and urea was top dressed on the same day. The early fertilizer application was not useful for increasing tiller and panicle count, and not effective to increase number of spikelets per panicle as clearly seen in Table 2. Insufficient soil humidity caused by scarce rainfall at maturity also must have inhibited development of fertilized grains.

Table 2. Performance of five lowland rice varieties at three locations

Site of trial (Latitude, North)	Variety	Hills per Row	Tiller per Hill	Days to First Heading	Panicle Count	Grains per Panicle	Yield per 3 Rows (kg)	1,000-grains Weight (g)	Yield Estimate (t//ha)
Glazoué (7° 55' 17")	V 14	42.8	13.3	62.0	129	229.4	1159.6	30.1	2.58
	V 20	46.2	13.3	62.0	126	194.4	1034.0	28.7	2.30
	V 26	45.5	12.8	62.0	124	221.7	1181.9	29.0	2.63
	V 28	43.9	15.5	62.0	149	220.8	1617.0	29.0	3.60
	WITA 4	43.1	19.3	68.0	187	268.3	1799.2	26.6	4.00
Bagou	V 14	32.9	12.0	80.0	–	–	–	–	–
	V 20	31.1	12.0	70.0	–	–	–	–	–
	V 26	30.6	11.8	72.0	–	–	–	–	–
	V 28	26.9	8.8	72.0	–	–	–	–	–
	WITA 4	30.9	10.4	77.0	–	–	–	–	–
Cobly (10° 28' 27")	V 14	48.2	16.8	77.0	239	120.1	1143.	28.1	2.54
	V 20	47.0	18.6	75.3	271	126.2	1190.3	27.4	2.65
	V 26	48.4	15.7	74.0	260	123.7	1138.7	28.0	2.48
	V 28	48.1	16.4	75.3	246	124.2	1255.0	28.4	2.79
	WITA 4	49.1	13.8	84.0	247	143.5	1241.4	25.3	2.77

Glazoué : Replanted NERICA field, set up 18 days after the first planted field, and plant growth is somewhat retarded.

Glazoué : Leaf yellowing specific to V-14, which was observed in other locations, too.

Bagou : Soil is going to dry up because of no rainfall, but rice is not yet reaching to the full heading stage.

Cobly : NERICAs are going to mature, but grain filling would be incomplete because of low soil moisture.

Conclusion

Upland NERICA trials at five locations resulted in reasonable evaluation only at one location. Causes of failure were drought or floods either at earliest growth stage or at maturing stage, attacks by rodents, and inappropriate field management especially timing of fertilizer application. Efforts to improve soil as for the capacity of holding soil moisture as well as soil fertility are required, too. Raising a seedbed for transplanting upland rice might not be a crazy idea but should be tried to extend the safer growth period of upland rice. Wherever some amount of water is available, raising seedlings of upland rice before starting of the rainy season will secure the longer and safer growth period, and might be possible to complete maturation before the end of rain. The wonderful growth of transplanted upland rice was observed at Glazoué, and also at the headquarter of SONGHAI in Porto-Novo. It is said that farmers, growing sorghum and maize in the area suffering from *Striga* (a group of parasitic plants which becomes active by the stimuli of germination of crop plants), practice transplanting of these crops.

For lowland NERICA trials, the same problems in management of water and soil can be mentioned. Damages by rodents as well as birds may be much less than in upland cultivation. Other important issue in lowland NERICAs is impurity of varieties. Though the number of off-type plants was not reported from many sites, it was observed that further selection should be conducted in most of tested lowland NERICA varieties to avoid, in the future, confusion of recognizing the varieties after wide dissemination within the country.

Acknowledgement

JAICAF extends their appreciation to INRAB for conducting the NERICA trials in 2007 with great efforts in organizing the system to smoothly conduct the trials in different locations, though the weather conditions did not favor with good results.