SUMMARY OF COOPERATIVE NERICA TRIALS, THE WET SEASON, 2008, IN BENIN

JAICAF conducted a series of upland NERICA trials, funded by the Ministry of Agriculture, Forestry and Fisheries of Japan, in the wet season of 2008 in Benin. The trials were achieved in cooperation with INRAB (Institut National des Recherches Agricoles du Bénin), SONGHAI (NGO), and CASTOR (NGO). This summary reports responses of upland NERICA varieties to cultivation under dry/ wet conditions, and with/without fertilizer application.

These trials were carried out as part of the five-year **Study on the Extension of Technologies for Sustainable Food Production in Africa** from 2004 to 2008. Target countries were Ghana from 2004 to 2006, and Benin from 2006 to 2008. Please refer our websites as below.

- The results of NERICA trials in Ghana, 2004: http://www.jaicaf.or.jp/English/nerica_e.htm
- The results of NERICA trials in Benin, 2007: http://www.jaicaf.or.jp/news/nerica_e.pdf
- Overviews of the Study: http://www.jaicaf.or.jp/news/africa0903_e.pdf

I. Upland NERICA cultivation under upland and lowland conditions

The five INRAB trial sites tested upland NERICA varieties under upland conditions, and Glazoué and Bagou tested also under lowland (locally called 'bas-fond') conditions. CASTOR, a NGO based at Glazoué, joined the trial, planting the same material both under upland and lowland conditions.

The results indicated that upland NERICA varieties could perform better under wetland conditions.

Trial sites : Site names of INRAB are the same as those in 2007, but locations are different. Lowland fields are in most cases rainfed, and not always flooded.

INRAB	1.	Dangbo	(Ouémé Department)	Upland
	2.	Covè	(Zou Department)	Upland
	3.	Glazoué	(Collines Department)	Upland and lowland, at the different location
	4.	Cobly	(Atacora Department)	Upland, (and lowland abandoned)
	5.	Bagou	(Alibori Department)	Upland and lowland, at the different location
CASTOR	1.	Monkpa	(Savalou District, Collines Department)	Upland and lowland
	2.	Lama	(-ditto-)	Upland and lowland
	3.	Logozohê	(-ditto-)	Upland and lowland

Varieties tested : Nerica-1, Nerica-2, Nerica-4, and Nerica-6, with the check variety INARIS 88 for the upland trial, and INARIS 88 plus WITA 4 for lowland trial.

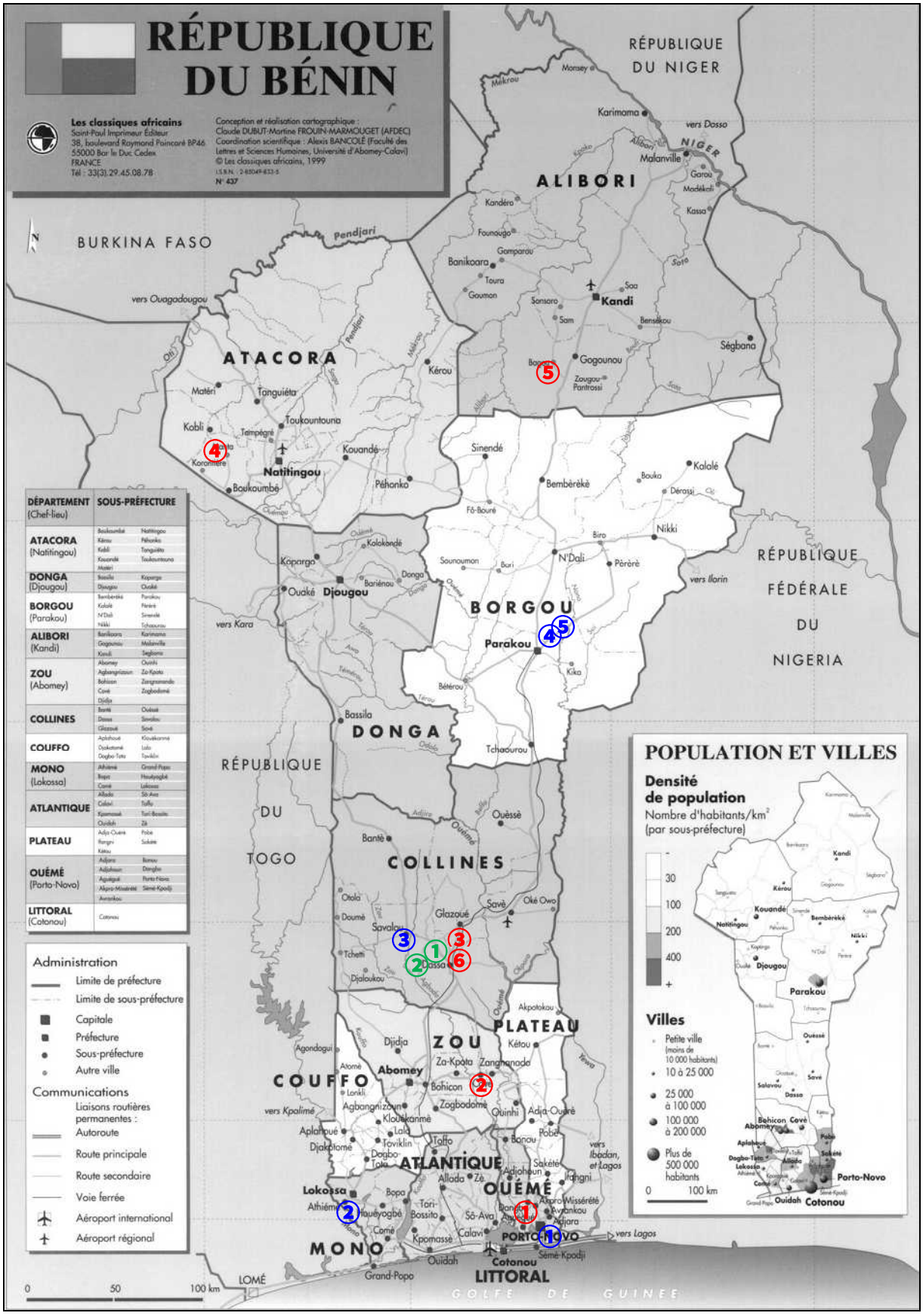

Fig.1. Location of the trial sites in 2008

INRAB：①Dangbo ②Covè ③Glazoué ④Cobly ⑤Bagou ⑥Léma **CASTOR**：①Monkpa & Logozohê ②Lama **SONGHAI**：①Porto-Novo ②Kinwédji ③Savalou ④Parakou ⑤Darnon

Plot design and cultivation： One plot of 10m^2 (5m×2m), with 8 rows (25cm between rows)×40 hills per row. Randomized complete block design with 3 replications.

Direct seeded both in upland and lowland, and later the number of seedlings were adjusted to 3, by thinning or supplemental transplanting. Basal application of composite fertilizer (14N:23P:14K +5S:1B) of 200 kg/ha, and topdressing of urea 75 kg/ha, 1-3 hand weeding conducted.

Items recorded：[denotation in the table]

- Number of standing hills per row (3 rows counted) [Hill count]
- Number of tillers at 60 days after seeding [Tiller count]
- Days to the first heading and 50 % heading [First heading, 50% Heading]
- Weight of total, filled, and infertile grains from the middle 3 rows. [Total grain wt., Filled grain wt., Empty grain wt.(g)]
- Yield (t/ha) was estimated from the weight of filled grains. [Estimated yield]

Plant height at maturity, number of offtype plants, number of panicles per m^2, number of grains per panicle, panicle weight, and 1000 grain weight were not checked in 2008.

Observation and test results： JAICAF team visited and observed all the test sites in late September to early October. Testing fields were rented from farmers, and mostly located in slightly sloped lands. Due to more rainy days than usual in 2008, fertilizers applied seemed to be partly lost in upper plots and received in lower plots. Test results obtained at each site are shown in the table as means of 3 replications.

The difference of performance between upland and lowland conditions was not clearly obtained as presumed. Both of the two sites of INRAB had upland and lowland fields in different locations, while all the sites of CASTOR had the fields at the same locations. Lowland fields were not always flooded under rainfed conditions, while upland fields received more rainfall than usual.

INRAB

1. Dangbo (Zoungue, Upland: Visited on 26 September)

Basal fertilizer and seeding on 7 August; Urea topdressed on 2 September (57 DAS); Weeding once on 1 September.

Obviously sloped from the two directions (Photo 1), and plant growth was much different among plots. At the 50 days after seeding, plants in some plots seemed as if only 3 weeks, and some corners were damaged by goats. Topdressing of urea was much delayed due to no rainfall. The trial seemed to produce little valuable information under such situations.

Photo 1. Upland field, Dangbo

No harvest of WITA4 was reported as due to late maturity. However, considering the small difference of heading of INARIS, the test was discontinued in the end.

Table 1. Dangbo

Variety	Hill count	Tiller count	First Heading (DAS)	50% Heading (DAS)	Total grain wt. (g)	Filled grain wt. (g)	Empty grain wt. (g)	Estimated Yield (t/ha)
N-1	48.0	10.3	63.3	77.0	342.0	275.0	63.7	0.73
N-2	46.3	9.7	62.7	76.0	233.7	182.7	51.0	0.49
N-4	44.3	9.3	63.0	76.3	309.3	240.0	69.3	0.64
N-6	47.7	10.0	66.3	78.7	465.7	367.3	98.3	0.98
INARIS 88	48.3	7.7	72.0	84.0	96.7	59.7	37.0	0.16
WITA 4	46.0	8.3	82.7	86.0	0	0	0	0

2. Covè (Koussin, Upland: Visited on 29 September)

Basal fertilizer application and seeding on 2 August; Topdressing on 19 September (48 DAS) and two hand-weedings were conducted.

Test field was newly cultivated, and seemed not fertile. Rainwater was running on the gentle slope. Soon after topdressing, rainfall washed off the fertilizer, and urea was again applied. But the plant growth was not stimulated. Plant vigor seemed clearly better in lower plots than the upper ones. In some plots, many missing hills were observed (cf. Photo 2). Symptom of iron toxicity was observed, especially in INARIS.

Photo 2. Upland field, Covè

Table 2. Covè

Variety	Hill count	Tiller count	First Heading (DAS)	50% Heading (DAS)	Total grain wt. (g)	Filled grain wt. (g)	Empty grain wt. (g)	Estimated Yield (t/ha)
N-1	39.0	5.7	57.0	66.7	1128.3	1000.3	128,3	2.67
N-2	38.7	5.7	55.0	64.7	963.0	824.0	139.0	2.20
N-4	37.0	6.3	57.0	67.0	1670.7	1542.0	128.7	4.11
N-6	40.0	7.0	58.0	68.3	1253.7	1042.3	211.3	2.78
INARIS 88	40.3	8.0	64.0	73.3	1371.0	1085.7	285.7	2.90

3. Glazoué (Upland: Egbessi, Lowland: Akpikpi. Visited on 30 September)

Upland and lowland fields were established at different locations. The calendar of field management was reported with much confusion and unable to explain.

In upland, basal fertilizer was applied on 19 July, and seeded on 20 July. Topdressing on 11 October, three hand weedings started on 30 August. In lowland, basal fertilizer application and seeding on 19 July, topdressing on 11 October. Three hand weeding, starting 7 August.

JAICAF team visited on 70 days after seeding, and panicles of early varieties such as N-2 and N-4 were already drooping, assuring that the rice was seeded in mid July. The rain on the night of topdressing moved urea applied in the lowland, and plant growth in the upper stream area became much inferior to that in the down stream. Generally, lowland plots seemed to perform better than upland (Photo 3).

Photo 3. Lowland field, Glazoué

Data of days to heading reported was quite abnormal (20-30 days greater) and ways of correction were not found, therefore data were deleted from the table. Yield data of INARIS 88 in the upland trial was missing for the rep.3, therefore the yield was estimated using only two data.

Table 3. Glazoué

Upland

Variety	Hill count	Tiller count	First Heading (DAS)	50% Heading (DAS)	Total grain wt. (g)	Filled grain wt. (g)	Empty grain wt. (g)	Estimated Yield (t/ha)
N-1	32.3	8.3			1099.0	1000.0	98.7	2.67
N-2	36.0	10.0			1167.0	1055.3	112.0	2.81
N-4	35.0	9.3			1154.0	1036.7	117.0	2.76
N-6	26.3	9.3			1190.0	1095.7	94.7	2.92
INARIS88	23.3	9.3			1159.5	1072.0	87.5	2.86

Lowland

N-1	40.0	11.5			1153.0	1077.7	75.3	2.87
N-2	37.3	10.7			1111.3	1000.3	111.3	2.67
N-4	38.3	11.0			1002.3	904.7	97.7	2.41
N-6	37.7	12.5			1097.7	1023.3	74.7	2.73
INARIS88	40.0	11.8			1141.7	1067.0	74.7	2.85

4. Cobly (Upland: Didori, Visited on 2 October)

Basal fertilizer application and Seeding on 29 July, topdressing on 19 August (should be: September), three weedings starting 17 August.

The upland field was newly established but seemed fertile and rice plants looked vigorous. But many missing hills were observed, as much as 50% in the worst plot (Photo 4), and as seen in the hill count in the table. The lowland trial was set up at different location. However, too much rainfall caused quite low germination and high percentage of missing hills. Besides, plant growth was so poor, thus it was decided to abandon the lowland trial.

Photo 4. Upland field (missing hills), Cobly

Table 4. Cobly

Variety	Hill count	Tiller count	First Heading (DAS)	50% Heading (DAS)	Total grain wt. (g)	Filled grain wt. (g)	Empty grain wt. (g)	Estimated Yield (t/ha)
N-1	31.7	10.6	64.0	71.0	1496.7	1306.3	190.7	3.48
N-2	28.3	8.9	62.0	69.0	1397.0	1158.3	235.3	3.09
N-4	30.0	8.3	66.0	74.0	1427.7	1311.0	116.7	3.50
N-6	31.7	4.6	69.0	77.0	1363.7	1212.3	151.3	3.23
INARIS88	30.3	14.3	74.7	89.7	834.7	515.0	319.0	1.37

5. Bagou (Upland and lowland. Visited on 4 October)

The upland trial was seeded on 16 July, and basal fertilizer applied on 29 July. Topdressed on 10 August (47 DAS). Three weedings starting 6 August. For the lowland trial, basal application and seeding was done on 12 July, topdressed on 27 August (46 DAS). Three weedings starting on 10 August.

The upland trial field located on a gentle slope, and plant growth is much better than in 2007, but clearly different between the upper (Photo 5, left side) and lower plots (Photo 5, right

side). The lowland trial field located about 5 minutes on foot, with no standing water, and plant growth was inferior to that in the upland trial (as seen in the tiller count in the table). Late varieties NARIS and WITA4 seemed to be badly affected under such conditions (Photo 6, 7). Heading was not regularly proceeding, and the field assistant had a problem of deciding when to harvest.

Low harvest for INARIS was explained to be damages by rodents.

Photo 5. Upland field, Bagou. Plant growth is better in lower plots (right side).

Photo 6 & 7. Lowland field, Bagou. From left to right: N-1, N-2, N-4, N-6, INARIS, WITA4.

Table 5. Bagou

Upland

Variety	Hill count	Tiller count	First Heading (DAS)	50% Heading (DAS)	Total grain wt. (g)	Filled grain wt. (g)	Empty grain wt. (g)	Estimated Yield (t/ha)
N-1	32.3	13.3	69.3	76.7	1188.7	979.3	209.3	2.61
N-2	33.0	13.3	61.7	75.3	1194.7	1009.0	185.0	2.69
N-4	30.0	13.0	66.3	77.7	1112.0	850.0	262.0	2.27
N-6	36.0	10.0	69.7	82.0	824.0	603.3	220.7	1.61
INARIS 88	34.0	16.3	81.3	86.3	587.3	395.7	191.7	1.06

Lowland

N-1	39.7	9.3	58.0	69.0	855.0	771.3	83.3	2.06
N-2	40.0	9.7	56.0	66.0	922.3	871.0	51.3	2.32
N-4	40.0	7.7	58.0	68.0	863.0	779.3	84.0	2.08
N-6	37.7	7.3	58.0	67.0	800.3	724.3	76.3	1.93
WITA4	36.0	9.7	51.0	91.0	1787.3	1530.3	257.0	4.08

CASTOR

1. Monkpa (Upland and Lowland, Visited on 30 September)

Both of upland and lowland field seeded on 23 July after applying basal fertilizer. Topdressed on 22 September (61 DAS), and hand weeded three times starting 7 August.

Fields were developed on the slightly sloped land, with the upland block in the upper area, and the lowland block downwards(Photo 8, 9). Upland plots seemed like lowland due to recent rainfall, though the land would be dry in a week without rain. Iron toxicity was noticed in several plots of N-2 and N-6 of the upland block.

Yield of WITA in lowland was reported as zero. Responding to our inquiry of the reason, it was explained due to late heading than NERICA varieties by 20 days. However, in the presentation to the NERICA dissemination seminar on 6 December, 2008, the yield was shown in the graph as high as 4.5 t/ha. Therefore, this figure is used in the column of Estimated Yield, without filling three columns of grain weights.

Photo 8. Trial field, Monkpa

Photo 9. Damage by iron toxicity, Monkpa

Table 6. Monkpa

Upland

Variety	Hill count	Tiller count	First Heading (DAS)	50% Heading (DAS)	Total grain wt. (g)	Filled grain wt. (g)	Empty grain wt. (g)	Estimated Yield (t/ha)
N-1	39.0	5.6	57.0	66.7	868.1	789.2	78.9	2.10
N-2	38.7	6.6	55.0	64.7	740.9	698.3	42.6	1.86
N-4	37.0	5.0	57.0	67.0	1285.1	1217.6	64.2	3.25
N-6	40.0	8.1	58.0	68.3	964.5	906.8	57.7	2.42
INARIS88	40.3	8.4	64.0	73.3	1054.6	954.8	99.8	2.55

Lowland

N-1	40.0	9.4	56.7	69.3	1507.6	1372.8	134.7	3.66
N-2	40.0	7.8	55.0	67.0	1426.5	1347.0	79.5	3.59
N-4	39.5	7.6	57.0	69.0	1601.8	1493.1	108.7	3.98
N-6	40.0	8.9	57.7	71.0	1733.7	1611.8	121.8	4.30
WITA4	39.9	12.5	80.0	90.0				4.5

2. Lama (Upland and Lowland, Visited on 30 September)

Both of upland and lowland blocks were basal fertilized and seeded on 25 July. Topdressed on 20 September (57 DAS), and three hand-weedings started on 9 August

The topography was similar as Monkpa (Photo 10, 11) with rainwater flowing down through the field, and iron toxicity symptom of N-1 and N-2 in the upland block.

Photo 10. Trial field, Lama (1)

Photo 11. Trial field, Lama (2)

Table 7. Lama

Upland

Variety	Hill count	Tiller count	First Heading (DAS)	50% Heading (DAS)	Total grain wt. (g)	Filled grain wt. (g)	Empty grain wt. (g)	Estimated Yield (t/ha)
N-1	40.0	6.0	58.0	70.0	836.7	769.7	66.7	2.05
N-2	40.0	5.7	56.0	67.0	504.0	512.7	34.3	1.37
N-4	39.7	5.7	58.0	70.0	685.7	605.3	80.7	1.64
N-6	40.0	4.7	58.0	72.0	948.3	873.3	75.3	2.33
INARIS 88	40.0	7.7	51.0	91.0	1303.7	1139.3	164.7	3.04

Lowland

N-1	40.0	9.3	58.0	69.0	855.0	771.3	83.3	2.06
N-2	40.0	9.7	56.0	66.0	922.3	871.0	51.3	2.32
N-4	40.0	7.7	58.0	68.0	863.0	779.3	84.0	2.08
N-6		7.7	58.0	67.0	800.3	724.3	76.3	1.93
WITA4	36.0	9.7	51.0	91.0	1787.0	1530.3	257.0	4.08

3. Logozohê (Upland and Lowland, Not visited)

Both of the two blocks were fertilized and seeded on 28 July, and topdressed on 21 September (55 DAS). Three hand weeding, starting 12 August.

Table 8. Logozohê

Upland

Variety	Hill count	Tiller count	First Heading (DAS)	50% Heading (DAS)	Total grain wt. (g)	Filled grain wt. (g)	Empty grain wt. (g)	Estimated Yield (t/ha)
N-1	40.0	5.6	58.0	68.0	872.7	729.1	143.6	1.94
N-2	40.0	7.1	57.0	66.3	965.8	855.6	110.2	2.28
N-4	40.0	5.0	57.0	67.0	1060.5	924.8	135.7	2.47
N-6	40.0	8.9	58.0	68.3	934.7	886.4	48.3	2.36
INARIS88	40.0	10.0	64.0	73.3	1894.3	1383.0	511.3	3.69

Lowland

N-1	40.0	10.1	61.0	71.0	1587.0	1446.3	140.7	3.86
N-2	40.0	8.7	59.0	71.0	1494.7	1402.9	91.8	3.74
N-4	40.0	8.1	61.0	71.0	1528.7	1388.5	140.2	3.70
N-6	40.0	9.8	61.0	71.0	1570.0	1454.9	115.2	3.88
WITA4	40.0	12.8	83.0	92.3	1712.3	1451.6	260.7	3.87

Conclusions :

In West African countries, not a few people have prejudice that upland rice cannot be grown under irrigated conditions. However, NERICA can be much more successfully grown in irrigated fields as shown in the trials in Ghana in 2004 (http://www.jaicaf.or.jp/English/nerica_e.htm).

In 2008, NERICA trials were conducted comparing performances in upland and lowland fields, at 2 sites for INRAB and 3 sites for CASTOR. INRAB trials were conducted at different locations for upland and lowland, and direct comparison of the productivity was not possible.

On the other hand, three CASTOR trials conducted the comparison of performance under upland and lowland conditions at the same locations. Though the soil conditions were not dry and flooded, upland block was on the upper area, and lowland block was on the lower area of the slope. Including Logozohê site that JAICAF team did not visit, the lowland trial yielded more than the upland trial, and the average yield of the 4 NERICA varieties was remarkably higher in Monkpa and Logozohê. However, the yield difference may not be simply due to the soil moisture, because iron toxicity was more obvious in the upland block, and fertilizers seemed to be brought from the upper to the lower area.

WITA4 tended to yield higher in lowlands, and NERICA varieties did not always surpass INARIS 88 in uplands. As the trials were not conducted with good level of accuracy, it is difficult to conclude that NERICA varieties are more adapted to irrigated fields. However, considering the present unstable situation for upland rice cultivation, it can be said that NERICA can be safely planted in lowland fields if not in stagnant water, rather it may be more recommendable than to plant under dry land conditions.

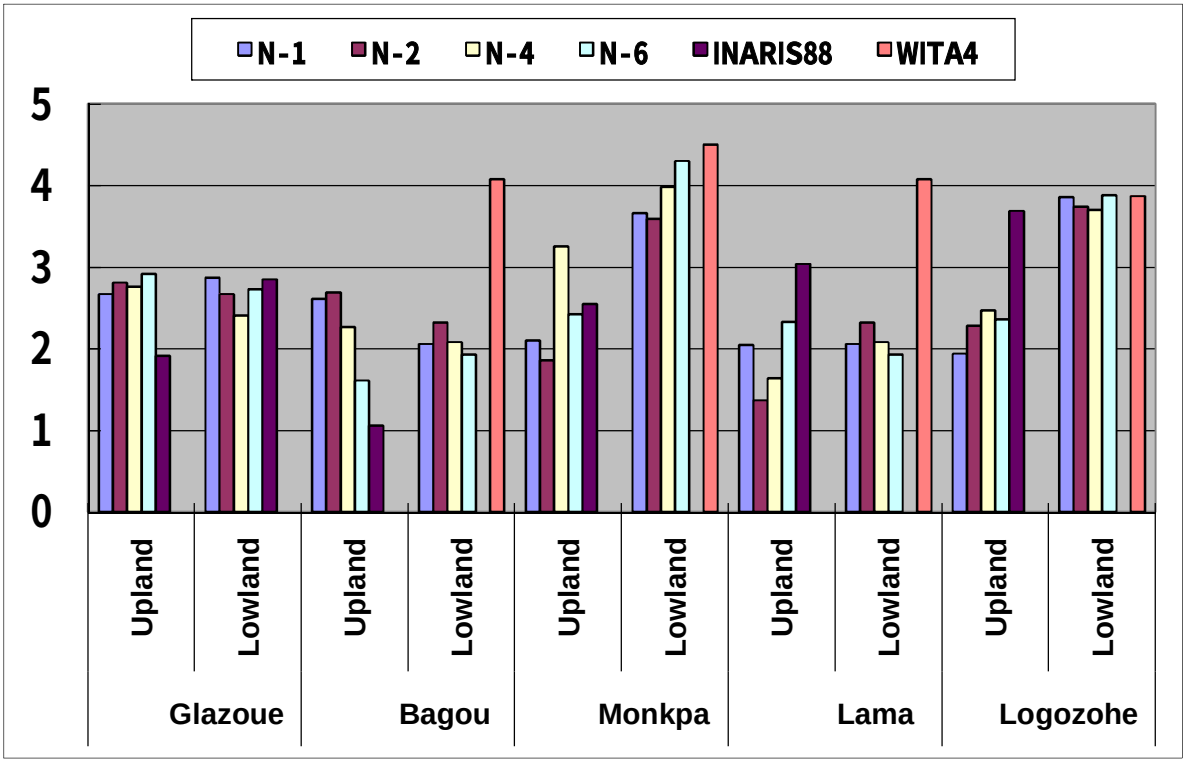

Fig. 2. Rough rice yields (t/ha) of NERICA under upland and lowland field conditions

II. Responses of upland NERICA to chemical fertilizers: SONGHAI trials

Locations of the trials :

1. Porto-Novo (Ouémé Department) SONGHAI Headquarter, Upland, Direct seeded
2. Kinwédji (Mono Department)) SONGHAI Center, Irrigated, Transplanted
3. Savalou (Collines Department) SONGHAI Center, Rainfed lowland, Transplanted
4. Parakou (Borgou Department) SONGHAI Center, Rainfed lowland, Direct seeded
5. Darnon (Borgou Department) Cooperative farmer, Rainfed lowland, Direct seeded

Varieties tested :

Upland NERICA varieties, N-1, N-2, N-4, N-6 were commonly used with the upland check variety INARIS 88, and lowland check variety WITA4.

Plot design and cultivation :

For fertilized block, 200 kg/ha of composite fertilizer (14N:23P:14K+5S+1B) was used as basal, and 75 kg/ha of urea (N 46%) was topdressed. In Porto-Novo, even the soil of the no-fertilizer block is very fertile due to organic fertilizers applied successively to the field where vegetable has been continuously cultivated.

The plot size is 5 x 2 m, with 1 m space between plots, and 1.5 m space between the block. Planting density is 30 x 10 cm. Each plot contains 8 rows x 50 hills, with 3 plants per hill. In case of direct seeding, 5 grains were sown and later adjusted to three seedlings by roguing or replanting.

Basal fertilizer was applied on the day of seeding or transplanting. and topdressing was basically given 6 weeks after seeding, after weeding in case of upland, and after draining in case of lowland.

Items recorded :

Beside those recorded in INRAB and CASTOR trials, the following items were reported: GPS information (latitude, longitude, elevation), crops grown in the past 3 years, plant height at maturity, number of grains per panicle, percentage of fertile grains, weight of 1000 fertile grains.

Observation and comments at visit :

1. Porto-Novo (06° 30, 031'N, 21 m ASL, Visited on 26 September)

Sugarcane, lettuce and pepper had been planted in the field. Seeded on 21 July after basal fertilizer application, and plant number per hill was adjusted on 6 August. Two hand weeding starting 8 August, and topdressed on 8 September (49 DAS).

Upland trial. The severe yellowing of plants seen in 2007 was not observed this year, and plant growth both in fertilized and non-fertilized blocks was good, though brown spots were noticed in flag leaves in the non-fertilized block (Photo 12). High yields were expected.

Photo 12. Brown spots in non-fertilized block, Port-Novo

At Porto-Novo, comparing to INARIS88, and to lowland cultivation in other sites, the yield of upland NERICA varieties is much higher. Also, the difference of yield between the fertilized and non-

fertilized blocks is not remarkable. This is considered to be due to high soil fertility of upland fields at Porto-Novo, owing to organic fertilizer (biogas slurry) which had been applied in the past.

Table 9. Porto-Novo

Fertilized

Variety	Hill count	Tiller count	50% Heading (DAS)	Plant height (cm)	Panicle count	Filled grain wt. (g)	Panicle wt. (g)	No. grains/ panicle	1000 grain wt. (g)	Estimated yield (t/ha)
N-1	47.6	13.9	66	106.0	346.3	2951.0	4.70	194.1	30.6	8.24
N-2	48.1	14.3	63	110.8	273.7	2997.0	4.67	207.5	27.7	8.29
N-4	49.4	14.4	64	110.1	314.3	3032.3	4.60	200.7	30.2	8.49
N-6	48.1	10.1	68	122.0	216.0	2887.0	5.37	214.1	30.6	8.01
INARIS 88	48.7	16.1	77	127.6	312.0	1900.0	5.10	223.9	26.0	6.19

Non-fertilized

N-1	47.6	13.5	66	102.6	316.7	2827.7	4.17	185.5	28.9	7.85
N-2	48.1	14.5	63	98.3	345.3	2891.0	4.13	146.7	26.7	7.94
N-4	49.4	11.9	64	98.5	327.7	2956.7	4.37	164.0	31.7	8.25
N-6	48.1	8.4	68	111.3	269.3	2821.0	4.67	199.6	26.8	7.95
INARIS 88	48.7	13.1	77	120.9	344.0	1926.0	4.63	226.5	26.3	5.55

2. Kinwédji (06 ° 43.017 ' N, 27 m ASL, Visited on 27 September)

Rice had been grown in the past 3 seasons. Seeded on 5 August and transplanted 3 weeks later, three days after basal fertilizer was applied. Three hand-weedings started on 12 September with 20 days interval.

Irrigated by underground spring but not deeply flooded. The fertilized block is adjacent to the threshing area. Perhaps due to this location, several plots in the block suffered attacks by stemborers. Insecticide D6 was sprayed 2 weeks and 4 weeks after transplanting, but many dead hearts were noticed especially in high tillering varieties INARIS and WITA4.

In this center, the amount of fertilizers usually applied is one half of the present trial. Plant growth in the fertilized block was observed clearly better in plant height and leaf color. The average yield increase in fertilized block is 36% over the non-fertilized block. The spectacular high yield of WITA 4 was calculated from the fertile grain weight, which may partly be due to the high number of panicles per unit area (though much reduced by stemborer in Rep.1). But the detailed explanation is not available.

Table 10. Kinwédji

Fertilized

Variety	Tiller count	50% Heading (DAS)	Plant height (cm)	Panicle count	Filled grain wt. (g)	Panicle wt. (g)	No. grains/ panicle	1000 grain wt. (g)	Estimated yield (t/ha)
N-1	11.3	69	101.3	215.8	1850.0	4.70	128.7	32.5	5.23
N-2	12.6	64	105.2	217.0	1450.0	4.20	126.3	29.8	4.18
N-4	12.9	67	107.5	215.4	1650.0	4.73	153.4	30.4	4.93
N-6	12.3	70	127.9	224.4	1206.7	4.67	175.2	29.7	3.54
INARIS 88	13.7	74	113.8	237.5	1866.7	4.37	138.8	29.2	5.21
WITA4	14.2	76	113.8	290.8	2600.0	4.87	154.9	30.7	8.84

Non-fertilized

N-1	11.4	69	92.0	130.3	1138.7	4.50	122.4	30.7	3.27
N-2	11.6	64	98.7	163.7	1230.7	4.50	111.7	33.6	3.47
N-4	10.9	67	105.4	144.0	1212.0	4.13	108.3	32.0	3.52
N-6	11.2	70	126.7	134.7	1059.7	4.73	113.2	30.1	3.04
INARIS 88	13.4	74	115.0	187.3	1240.0	4.37	136.9	29.7	3.56
WITA4	14.4	76	117.2	229.3	2166.7	4.30	147.3	33.4	6.51

3. Savalou (07 ° 58.199 ' N, 168 m ASL, Visited on 1 October)

The field had been planted to rice since 2006. Seeded on 3 August, and transplanted on 21 August after basal fertilizer application. Weedings on 8 September and 12 October. Topdressing on 22 September (50 DAS).

The field was very well managed and clean. The land was very gently sloped, and non-fertilized block was in the upper area, therefore, the fertilized block might be favored by water flow containing nutritions more than the treatment (Photo 13, 14).

Among the 4 sites of lowland trials, Savalou could achieve the best, but the difference between the fertilized and non-fertilized blocks was only 10 %. This is perhaps due to relatively high soil fertility as observed when the JAICAF team visited before heading.

Photo 13. Fertilized block, Savalou

Photo 14. Non-fertilized block, Savalou

Table 11. Savalou

Fertilized

Variety	Tiller count	50% Heading (DAS)	Plant height (cm)	Panicle count	Filled grain wt. (g)	Panicle wt. (g)	No. grains/ panicle	1000 grain wt. (g)	Estimated yield (t/ha)
N-1	12.3	72.3		401.4	1979.2	3.86	188.0	32.2	5.57
N-2	11.6	68.7		478.4	2061.9	3.94	202.0	31.9	5.79
N-4	10.4	70.3		420.8	1936.7	4.83	230.0	32.0	5.54
N-6	10.0	72.0		375.8	2057.3	6.35	286.3	33.3	5.70
INARIS 88	20.5	79.7		536.9	1807.3	5.23	247.6	32.1	5.05
WITA4	19.1	89.7		654.7	2141.3	5.53	305.5	32.4	6.00

Non-fertilized

N-1	11.4	72.3		387.7	1983.3	3.79	179.1	30.8	5.29
N-2	11.1	68.7		459.3	2029.8	3.94	197.4	29.9	5.41
N-4	10.0	70.3		407.3	1875.5	4.80	226.1	31.1	5.00
N-6	9.2	72.0		361.3	1990.0	5.70	286.4	31.9	5.31
INARIS 88	18.8	79.7		508.7	1410.3	5.11	250.0	32.1	3.76
WITA4	17.9	89.7		595.3	2130.3	5.20	299.8	30.3	5.68

4. Parakou (09 ° 24.719 ' N, 229 m ASL, Visited on 3 October)

In the rainfed lowland field, rice had been grown continuously for 8 years. Basal fertilizer application and direct seeding on 4 August, two hand weedings on 16 Aug. and 8 Sept. Topdressing of urea on 15 Sept. (42 DAS) The field is not fertile and Nerica-1 here usually yields around 2.2 t/ha.

Five grains per pocket were seeded and after germination number of seedlings was adjusted to 3. Plant growth seemed clearly different between fertilized and non-fertilized blocks. Spittle bug (*Locris rubra* Fabricius), identified by WARDA entomologist by photo 15, was also observed swarming in 2007 in farmers field. This bug is said to transmit RYMV(Rice yellow mottle virus).

The fertilized block produced 72% more than non-fertilized block,

showing good effects under relatively low fertility field conditions. As the field was on the flat land, there were little loss of fertilizers due to rainwater. The fertilized block was a little inferior in crop stands, but far better in any of other recorded items.

Photo 15. *Locris rubra* Fabricius

Table 12. Parakou

Fertilized

Variety	Hill count	Tiller count	50% Heading (DAS)	Plant height (cm)	Panicle count	Filled grain wt. (g)	Panicle wt. (g)	No. grains/ panicle	1000 grain wt. (g)	Estimated yield (t/ha)
N-1	41.8	13.1	63	93.3	267.3	1651.0	3.33	136.7	33.3	4.54
N-2	38.3	12.1	61	95.7	291.0	1781.7	4.67	147.0	31.0	4.90
N-4	37.1	14.4	67	106.3	216.0	1743.7	4.33	171.0	32.0	4.84
N-6	40.3	10.9	68	121.0	233.0	1474.3	6.33	347.7	30.7	4.17
INARIS 88	46.4	16.4	78	118.2	278.0	1557.0	6.33	314.3	30.0	4.43
WITA4	42.6	19.2	74	93.1	324.3	1250.0	5.00	193.7	30.3	3.78

Non-fertilized

N-1	43.7	7.8	67	77.3	241.7	785.3	3.67	114.0	30.3	2.17
N-2	41.2	7.6	59	80.6	248.0	992.0	3.33	117.3	29.7	2.74
N-4	37.9	8.1	66	82.8	174.0	863.0	3.67	112.0	31.0	2.41
N-6	40.8	6.0	67	100.6	224.7	1003.3	5.33	185.0	30.7	2.89
INARIS 88	44.0	11.6	72	93.9	226.7	1092.7	4.67	160.0	30.0	3.13
WITA4	42.0	12.7	77	79.0	277.3	677.0	4.00	143.3	29.3	2.20

5. Darnon (09 ° 26.640 ' N, 318 m ASL, Visited on 3 October)

This farmer moved from Atacora and cultivates soybean, sorghum, yam and other crops in several ha. The trial field was newly cleared in the lower area of sloping grass land where he conducts shifting cultivation of local rice every year. Basal fertilizer was applied and seeded on 6 August, and hand weeding was don once on 1 September. Topdressed on 17 September.

The plots (N-2, INARIS and others) in the upper border of the trial field (fertilized block) were affected by some soil problem (Photo 16). One plot in the non-fertilized block was severely attacked by insect (Photo 17), which disappeared already and only one tiny larva of about 2 mm could be found.

In contrast to Parakou, various problems, such as soil and pests, disturbed the trial inducing results of little effects of fertilizer application.

Photo 16. Soil problem in the upper border, Darnon

Photo 17. Severe damage by insect, Darnon

Table 13. Darnon

Fertilized

Variety	Hill count	Tiller count	50% Heading (DAS)	Plant height (cm)	Panicle count	Filled grain wt. (g)	Panicle wt. (g)	No. grains/ panicle	1000 grain wt. (g)	Estimated yield (t/ha)
N-1	39.7	10.4	65	90.6	265.7	1465.0	4.67	141.7	29.7	4.06
N-2	37.0	11.4	64	84.9	273.0	1195.3	4.00	110.3	29.3	3.29
N-4	38.6	13.7	70	95.1	237.3	1209.7	4.00	141.0	30.3	3.36
N-6	40.8	7.7	68	111.8	205.3	1618.3	5.33	217.0	30.0	4.49
INARIS 88	45.6	20.8	74	102.6	251.3	1324.0	5.33	171.7	28.7	3.88
WITA4	41.0	25.5	77	97.2	288.3	1625.3	4.67	155.7	31.0	4.54
Non-fertilized										
N-1	37.1	8.4	65	82.3	186.0	785.3	4.67	126.7	29.3	2.26
N-2	37.8	10.5	64	94.6	274.3	1214.7	5.33	125.7	29.3	3.53
N-4	35.9	8.9	70	96.0	107.7	1044.7	4.67	130.3	30.0	2.94
N-6	38.7	8.2	68	122.4	218.7	1761.3	6.67	209.7	30.3	4.98
INARIS 88	29.8	19.6	74	112.3	321.0	1403.0	4.00	209.3	27.0	4.35
WITA4	36.8	15.1	77	98.6	342.0	1695.3	5.33	125.3	28.7	4.88

Conclusions :

In general, WITA4 tended to perform better under unfertile or non-fertilized lowland conditions Nerica-6 seemed to be more adapted to those conditions than Nerica-1, -2, or -4. Regarding observation of off-type plants, data was omitted from the tables, because the results were quite different among trial sites. The check varieties, INARIS and WITA4, were recorded as 0, perhaps due to their familiarity compared to NERICA varieties. This may indicate that they need some guidance in identifying off-types, and suggests difficulty of keeping genetic uniformity of new varieties.

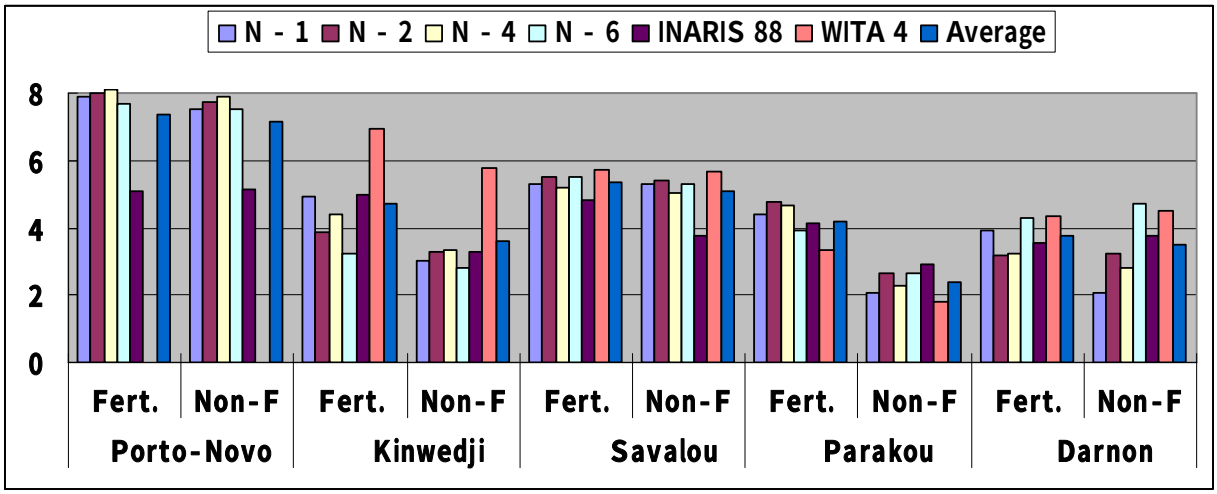

Fig. 3. Rough rice yields (t/ha) of NERICA under fertilized and non-fertilized fields