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Poverty Alleviation through NERICA Introduction into Semiarid Sub-Saharan Africa

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Abstract: This study discusses possibility of NERICA (New Rice for Africa) introduction into semiarid Sub-Saharan Africa verifying a successful case of cultivation in Uganda from view point of its productivity, economical profit and water consumption, compared to other cereals in semiarid Sub-Saharan Africa. The following points were argued, 1: Productivity of NERICA is significantly better when compared to other crops, 2: Profit of NERICA production is much higher than other crops, 3: NERICA could be cultivated stably with consecutive irrigation pond system under severe semiarid conditions. As s result it would be possible to alleviate poverty in Sub-Saharan Africa with introduction of NERICA from productive and economical point of view.

Keywords: NERICA, Semiarid area, Sub-Saharan Africa, Uganda

1. Introduction

The Government of Japan manifested strong support for doubling rice production in Africa as the most important agricultural support of Japan in the fourth Tokyo International Conference on African Development (TICAD 4) held in May, 2008 in Yokohama, Japan. The plan, doubling rice production within ten years, is ambitious challenge which promotes suitable cropping, mixing lowland rice and upland rice based on climate condition and access to water. The support activities are implemented not only by the Government of Japan but other international agricultural research institute such as WARDA and IRRI. Semiarid area covers major part of Sub-Saharan Africa and there are many poor countries in this region, 34 least developing countries (LDCs) in Sub-Saharan Africa among 50 in the Development Assistance Committee (DAC) under OECD recipient country list. However, it is considered that this semiarid region would be potential area for NERICA New Rice for Africa), upland rice, cultivation in the future. Therefore the possibility of NERICA introduction into semiarid area was studied referring to NERICA cultivation in Uganda.

2. Background and Methods

2. 1. Situation in Sub-Saharan Africa

Table 1 shows the changes in consumption and production of staple crops in Sub-Saharan Africa from 1970 to 2006 (FAO, 2008). For corn, sorghum, and millet, those consumptions have been comparable with the production for the past 30 years. For rice and wheat, the difference between consumption and production tend to increase and further increase in the production is expected. However, wheat is suitable to be cultivated only under cool condition in South Africa and Kenya, basically. Therefore increase in the wheat production would cease and continuous import will be needed to meet demand.

On the other hand, rice is basically a tropical crop and expected to increase its production under suitable condition. Consumption of rice is rising in urban area of each country

Table 1. Consumption and production of staple crops.

	1970	1980	2006
Rice	3,774 (3,056)	5,845 (3,657)	15,550 (8,726)
Corn	10,279 (11,027)	14,991 (14,776)	33,919 (33,183)
Sorghum	8,968 (8,900)	10,091 (10,243)	22,886 (22,451)
Millet	8,125 (8,127)	9,756 (9,692)	17,164 (17,164)
Wheat	3,199 (1,410)	5,072 (1,320)	14,776 (3,851)

Unit: 1,000 t, upper: consumption, lower: (Production)

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in Africa, depending on import for shortage from Asian countries such as Vietnam and Pakistan. For this reason, this paper pays strong attention to rice.

2.2. Situation in Uganda

In Uganda there are 100,000 ha of rice production area in 2007. **Figure 1** shows increase of upland rice, NERICA, cultivation area from 2000 to 2007. Since NERICA was introduced to Uganda in 2000, NERICA has been expanded rapidly and widely. NERICA cultivation area have reached to one third of total rice cultivation area in Uganda (35,000 ha). As upland rice requires less water, NERICA is therefore a hopeful crop in semiarid regions of Africa.

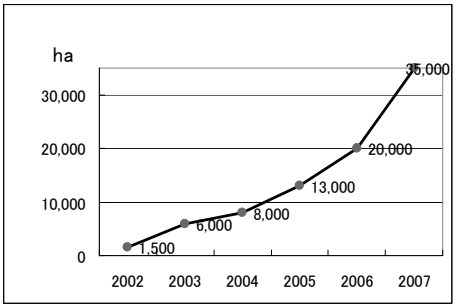

Fig. 1. Transition of NERICA cultivating area.

2.3. Research and analysis methods

The situation of crop production in Sub-Saharan Africa is very severe from view point of yield and therefore importance of NERICA is pointed out. This importance was studied in its productivity, economic aspect and water requirement of NERICA cultivation compared to other crops such as sorghum and millet.

3. Results and Discussion

3. 1 Cultivation of NERICA

Table 2 shows productivity of rice, sorghum and millet in Sub-Saharan Africa. Yield per hector of sorghum and millet has less significant difference between in Sub-Saharan Africa and world average. The yield per hector of these cereals seems to reach to its limit. Although varietals improvement has been tried and new varieties has been released in this area, it is considered that amount of rainfall is one of the important factor to limit the production. On the other hand yield per hector of rice is still the half of its world average. Therefore rice remains much room for improvement in its productivity toward world average.

Table 2. Productivity of rice, sorghum and millet (2006).

	Rice	Sorghum	Millet
Productivity(Sub-Saharan Africa average) t/ha	1.24	1.03	0.74
Productivity(world average) t/ha	2.73	1.44	0.82

Table 3. Millet production and productivity.

	1983	2003	Increment ratio
Cultivation area (ha)	3,135,550	5,771,293	1.8
Production (t)	1,298,345	2,744,908	2.1
Productivity (t/ha)	0.41	0.47	1.1

Table 4. Profit of NERICA.

Average cultivating area	0.4 ha
Yield	1.7 t/ha (with no fertilizer)
Market price	1,200 Ush/kg = US$0.655
Total production	1,700 kg/ha×0.4 ha = 680 kg
Domestic consumption	180 kg
Selling amount	500 kg×1200Ush = 600,000 Ush
Production cost	200,000 Ush
Gross profit	400,000 Ush (=US$218)

In order to understand more in detail comparison of productivity of millet in Niger from 1983 to 2000 is indicated in **Table 3** (Takahashi *et al*., 2007). The yield per hector has remained on the same level of 0.4 t/ha over the twenty years. It is obvious that the yield of cereals in this region has its limitation.

In contrast, as an example of productivity of NERICA, the average yield of NERICA in Uganda is 1.7 t/ha with sufficient rainfall. Most of cultivation in Uganda is under no fertilizer and no chemical application and reaches to double score in its productivity. It is considered that NERICA has efficiency in food security from view point of productivity.

3. 2 Economy of NERICA production

Economical aspect of NERICA production was studied from view point of its yield, market price and

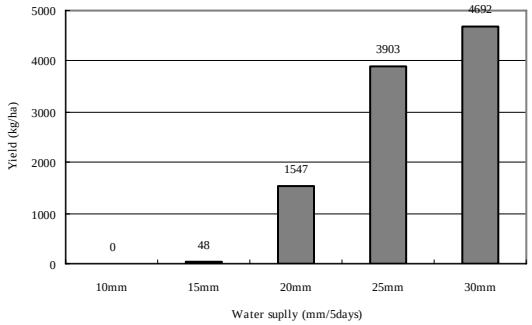

Fig. 2. Relationship between water supply and yield.

Table 5. Comparison of water consumption in cereals and rice.

	sorghum, millet	rice
plant life cycle (early ripening variety) day	90	100
evapo-transpiration ratio (crop coefficient)	1.1	1.0
water consumption (mm/day)	around 4	around 3～7

Table 6. Successive no-rain days in Namurongue, Uganda (2 years probability).

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
successive no-rain days	21.5	12.2	10.2	6.0	11.6	13.5	15.5	12.5	11.1	8.1	10.7	12.1

profit per cultivating area, and indicated in **Table 4**. Market price of rice is five times higher than corn (Jan, 2008: JICA unpublished data). In case of cultivation area of 0.4 ha, which is average cultivating area of farmers in Uganda, profit reaches to about US$220 except for domestic consumption and production cost. It values US$545/ha. This profit has very large impact considering GDP per capita in Uganda, US$300 in 2006. From economical aspect NERICA has higher merit than other crops. It is reported that NERICA cultivating farmers input more education cost for their children and repair their houses and improve their livelihood.

3. 3 Water requirement of NERICA

Sorghum and millet have been cultivated in semiarid region for a reason of its less water requirement. **Figure 2** shows relationship between the amount of irrigation water and unhusked rice yield in Namurongue agricultural experimental station, Uganda. Increasing rate of yield is significant with more than 20 mm/5 days (i. e. 4 mm/day) of irrigation. Setting the cultivating period as 100 days this figure indicates that it is possible to have more than 1.5 t/ha of yield with more than 400 mm of water apply during cultivating period.

Table 5 shows a comparison of water consumption between miscellaneous cereals (i. e. sorghum and millet) and NERICA (Takahashi *et al*., 2007). The consumption of these crops is almost on same level. Since sorghum and millet have been cultivated in semiarid area due to difficulty of water supply, it is possible to cultivate NERICA in this region.

Since water is essential factor in crop production, irrigation ponds which assure the maximum use of rainfall would bring stable NERICA cultivation. **Table 6** shows successive no-rain days per month with two years probability based on rainfall data from 1990 to 2006 in Namurongue. **Table 6** indicates clearly that successive no-rain days in March to May and September to November are small with less than twelve days.

For this reason, the drought risk is reduced with supplemental irrigation with irrigation ponds used for water harvesting. In case of other countries where the condition of water resources is more severe, the consecutive irrigation pond system will be a helpful measure to reduce the drought risk. Therefore, it is possible to introduce NERICA into dry Sub-Saharan Africa.

4. Conclusions

The introduction of NERICA into Sub-Saharan Africa was discussed from vies point of its productivity, economical aspect and water requirement based on situation of this region with successful

NERICA introduction case of Uganda. As a result, following points were argued from experiences in Uganda.

1. Productivity of NERICA is significantly higher compared to other crops such as sorghum and millet, and could be more improved.
2. Profit of NERICA production is much higher than other crops with more than US$500/ha.
3. NERICA could be cultivated stably with irrigation ponds or consecutive irrigation pond system under semiarid condition.

As mentioned above it is possible to alleviate poverty in Sub-Saharan Africa with introduction of NERICA from productive and economical point of view.

References

FAO (2008): *FAOSTAT*, Food and Agriculture Organization of the United Nations Statistics Division

Takahashi S, Kitanaka M., Nishimaki R., Takahashi S., Watanabe F. (2007): Potential to extend NERICA from a view point of water use in Africa. *Journal of Arid Land Studies*, **17**: 33-38.