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RIJSTPROGRAMMA

Project: 9ACP RPR006

SEED CONTRIBUTION IN IMPROVING THE COMPETITIVENESS OF THE RICE SECTOR IN SURINAME

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ACRONYMS AND ABBREVIATIONS

ADRON	Anne van Dijk Rijstonderzoekscentrum Nickerie
AOSCA	Association of Official Seed Certification Agency.
ATV	Agricultural and Technical Value
DUS	Distinctness, Uniformity and Stability
EC	European Commission
FAO	Food and Agriculture Organization
HRY	Head Rice Yield
ISTA	International Seed Testing Association
LOW	Landbouwkundig Onderzoek Wageningen
NZR	Nationale Zaadraad
OECD	Organization for Economic Co-operation and Development
REMUS	Research and Extension Management Unit Suriname
SEL	Stichting Experimentele Landbouw
SML	Stichting voor de Ontwikkeling van de Machinale Landbouw in Suriname
SNRI	Stichting Nationaal Rijstonderzoeksinstituut
TWRY	Total White Rice Yield
UPOV	Union pour la Protection des Obtentions Végétales Union for the Protection of Vegetal Obtaining

1 INTRODUCTION

Rice is the staple food in Suriname and rice production is the largest agricultural production. The rice sector represents an important portion of the economy as it employs a large fraction of the population and through exports contributes significantly to the foreign exchange earnings.

The country's total rice area cropped every season (two growing seasons per year) is presently about 20,000 hectares. Farming system in Suriname is intensive and modern. It makes large use of machinery and inputs. Rice is sown manually and more often by airplane using pre-germinated seed broadcasted in deep water. Varieties generally used have high yielding potential. In addition to water control, the major constraints in rice cultivation are weed control (especially red rice) and low usage of pesticides especially herbicides.

Yields in the fields remain relatively disappointing and low for that kind of agriculture. Milling efficiency is also an important problem that hampers the competitiveness of the Surinamese rice sector. Both limitations are partly resulting from the type of varieties grown. Extra long grain rice types have lower yields and the product is much more difficult to mill. But the major constraint is the consequence of the quality of the seed used by the majority of the farmers.

As part of the EU project objectives aiming at improving the competitiveness of the Surinamese rice industry, the need for improving seed availability and quality was identified. The present mission was one of the tools in identifying the weaknesses of and making recommendations to improve the situation.

The ToR detailed below of the present short term mission were prepared to help in improving the understanding of the seed sector and obtain direction of reflection for the future.

Those were:
Investigate the problems linked with rice seed production, certification and regulation, farmers' seeds, seed producers. Elaboration of guidelines for a sustainable seed production system, of quality seed breeding guidelines at farmers level.
Realization of training session and workshop for deciders, seed farmers and breeders.

The study should focus on

- Examine the seeds presently used by farmers. The varieties: yield potential and weaknesses. Recommend seed breeding strategies in view of market development in coordination with national breeding plans.
- Describe the existing seed production system and problems involved.
- Design an appropriate seed production system that would ensure better yields and marketing qualities. The sustainability and competitiveness of the system should be priorities.

- Describe the role that should ideally have, in present Surinamese conditions, the Government, the breeding centre (ADRON), the farmers and future certification institutions.
- Share experiences during training session and workshop including field training.
- The target groups being the deciders (government, Board, farmers and millers leaders), the seed breeders and the seed farmers.

The methodology of the work has consisted in:

- Data collection, meetings with resource persons and field trips
- Analysis and Reporting

The expert started on July 26 2008 with an initial briefing by the project team and provision of documents. The expert has gathered specific information and sought the participation of all stakeholders involved at different levels of seed production sector through interviews, at all levels and project beneficiaries.

The mission conducted a review and analysis of the information gathered. Particular attention was paid to assessing constraints and sustainability for the future development of the rice sector.

A workshop was conducted on the last day of the mission to share and validate the mission findings and collect reaction and comments on the conclusions and recommendations. The list of the workshop attendance in annexed to the report.

Three meetings with farmers and seed growers were also held.

2 DESCRIPTION OF SEED SUPPLY AND SEED USE EVOLUTION

2.1 SEED SUPPLY

In Suriname, as a rule seed production was not sufficient in volume to fulfil the farmers' needs. This situation might be the result of the combination of several factors. The most important could be (1) that rice is a self-pollinated species and that the farmers' saved seed is usually considered good enough to produce satisfactory crops and yields; (2) seed multiplication, processing and distribution need an organization that was never completely available or fully functioning.

In the past, rice varieties and their seed were originating from government institutions. Varieties were selected in SML that also produced a small amount of seed to meet the own needs of the Fundation. The area cropped could reach up to more than 17,000 ha per year (two seasons)[1]. For some time, SML would also deliver what could be called basic seed that would be multiplied by other private or government companies to supply the farmer's community needs. But due to problems of profitability, even this system collapsed and basic seed was not longer available.

According to the same report, it is obvious that the quantities of seed available were extremely limited. In the same time the quality could be relatively uncertain as the multiplication scheme could reach the certified-4 generation (derde nabouw).

The report describes also the seed supply system and the coexistence of three ways for a farmer to obtain the seed he would sow. Briefly, the luckiest would receive the seed from the well-structured scheme comprising of SML (basic seed), SEL (certified seed, dubbel geschoond). The others would have to try and get their seed from different sources like seed produced by other farmers.

Given the limited availability, the farmers' seed regeneration would usually be once in a while and the quantity purchased or received very small. The result is that the use of farmers' saved seed would in fact be the general practice. It is also noticeable that the importance of seed renewal was felt more valued when the red rice presence became more worrying. The report mentioned previously situates the emergence of that problem in the 60s.

In the 90s the SML and the Suriname seed sector received the assistance of various projects. FAO support consisted in training and equipment (i.e. seed processing plant). Nevertheless, the seed supply quenched with the collapse of the government institutions SML and SEL. This could be one among other reasons of production and export decline in the same period.

[1] Source : Report on the history of seed supply used by SML and the PBP, March 2008

The failure of public institutions coincides with the creation of ADRON that became responsible for the breeding of new performing varieties and that progressively became the main source of seed.

For a long time, farmers were used to procure a little amount of seed and multiply it on a small area. Usually they would put more attention and inputs to ensure a better yield and enhanced quality. The production of that plot would be used in the following season for the rest of the farm area. Frequently, the surplus could be sold to neighbours.

Often, the word seed could be confused with variety. The farmer can wish to change the variety he grows because he observed that a new one offers significant advantages (yield or resistance, technical ability…). Therefore he needs to find the seed but would be careful and try it on a small area before extending to the entire field.

This practice continues to be used now for the renewal of seed of the same variety. The farmers observe that the yield can decrease when they use the seed taken from their paddy fields for several seasons.

The varieties used by Surinamese farmers are relatively new varieties released by ADRON since 2001. The most popular was ADRON-111 but since two years it shares the success with ADRON-125. The newer ADRON-117 is relatively less spread due to its thinness and consecutive milling difficulties. Several new promising lines are being tested in farmers' conditions before a decision is taken on their release and larger scale seed production.

Surprisingly, among the farmers met, small but also large (1,200 ha), some still use very old varieties of which seed is no longer produced by the official system. The varieties most frequently mentioned were Groveni and Ferrini. But some still grow "Raimondo" or a "mix" of varieties. Those practices were justified by reasons concerning the quality of the variety or the destination of their production. Generally, the larger farms have their own mill and their outlets for the paddy they produce. More amazing and even uneasily understandable is that this paddy produced will find a mill that will buy and process it.

It was argued that those varieties or mixture of varieties are rough and adapt to severe conditions. They request lower investments in the field (fertilizers and care). The yield is considered sufficient and profitable for both farmers and millers. They are destined to the sale on local market and more especially for animal feed. Nevertheless, a part of the production is also mixed with the "normal" paddy and decreases the yield and the quality of the entire mill output.

2.2 ORIGIN OF SEED USED

Concerning the provenance of the seed used by farmers the survey conducted for ADRON by the consultant Hendrie N. Karijoikromo[2] gives interesting information (table1 below). One can

[2] Survey report: The demand for seed by paddy growers, December 2007, Hendrie N. Karijoikromo

see that in 2007 (the situation might have evolved as the number of seed growers and the amount of seed produced has increases since then), the majority of the farmers were mainly obtaining seed from their own stocks or from other farmers. In fact the tradition is that a farmer when he observes a field that looks better he will contact the owner to purchase part of the harvest. This seed is usually directly bought from the field (raw and wet) and the buyer will be responsible for drying and cleaning. Small farmers will limit the processing to sun drying. Bigger farmers can use the service of a miller to dry and clean the product.

It is also interesting to notice that the millers are also a source of seed. They normally proceed like the farmers and buy the production of the best looking fields or reserve a paddy delivery that is of better quality. That product is processed differently and sold as seed after drying and cleaning.

Table 1: Farmers' seed origin[3]

Variety	Own farm	Other farmer	Seed grower	Miller
ADRON-125	24	29	10	-
ADRON-111	18	28	1	3
ADRON-117	1	3	-	1
GROVENI	7	4	-	7
M2	7	8	-	3
Mix (Gr/M2)	2	3	-	-

As mentioned above, the proportion of seed purchased from seed growers might have expanded with the increased number of seed growers and the amount of seed produced. But the ratio might remain relatively low as there is no seed distribution and marketing system and seed growers will only sell in a very narrow radius.

It would be interesting to assess the amount of seed sold by the seed growers. From the visits and interviews with the Seed Growers Association, it seems that not much of the production is sold as seed. The impression was that the seed growers were essentially interested in the seed multiplication because they could obtain higher quality seed for their fields. That seed was basic seed or certified-1 seed. This confirms the awareness about the importance of good seed.

Another reason not to be forgotten is that there were also some financial advantages to embark in seed multiplication. Some inputs and assistance were provided by the EC project. They consisted in fertilizers and pesticides as well as training. Some remarks can however be made on the assistance given to the seed growers and more generally on the development of a seed production sector.

First, delays in the implementation have reduced the impact of the seed component of the project. In the same way the limitation of the support in term of amount as well as in quality might have lowered scope of the assistance. The main activities conducted by the project have been concentrated on the production aspects and more specifically on the first generations, up to the basic seed and the certified-1 seed. The certified-2 seed did not

[3] Idem

benefit much from the project (except for inputs and training). In the fields the seed production techniques have not really been different from the normal practices of paddy production. And that is mainly remarkable and damageable regarding the weed and red rice control.

Concerning the processing and marketing, the Seed Growers Association that has been created is left on its own. No support was brought to develop seed processing facilities and to initiate seed storage and sales on a structured basis. It was expected that drying and processing would be operated by millers. It is only recently that a consultant was hired to study the feasibility of the development of a seed processing unit that would be managed by the Association with the assistance of ADRON. Funding options include participation of ADRON, bank loans and government assistance (see Chapter 4.3 for more details).

In those conditions one can wonder about the sustainability of the Seed Growers Association as well as about the stability of the certified-2 seed production. It is not assured that that stage of the process in strong enough to last without further improvement and support. In fact not much has changed compared to what the situation was traditionally. The seed grower is still a farmer like any other. If he has a better field and product he has not any means to process it and sell it as what should be a seed. It is sold as wet seed and the buyer will take care of drying. Even if some seed growers dry in the sun or use the services of a miller and store the production to be sold to paddy farmers, the major part of the production will go to the mill and be processes like the normal paddy.

3 VARIETY SELECTION AND DIFFUSION

As pointed out above, rice selection in Suriname since the breakdown of SML is operated by ADRON. This research centre is itself part of the SNRI. It is in fact since 1994 that ADRON is responsible for the rice variety development in Suriname[4]. About 31 promising ADRON lines have been or are being tested. Now ADRON-111 and ADRON-125 are covering most of the area of Nickerie Polders. ADRON-117 is also found promising in farmers' fields. Two promising lines ADRON-128 and ADRON-130 are in commercial trials on different locations.

The breeding and seed production system followed in ADRON is one of its kinds and possesses a long history of improvement of varieties using introduction and hybridization. It resulted in development of short duration, very high yielding quality rice for export. Some of these are also being used in the breeding program elsewhere in the world[5]

The modern day man is highly quality conscious. The produce should not only bred for higher yield but also meet nutritional as well as cooking and eating quality. In ADRON while breeding and seed multiplication all the points- high yielding ability, quality consciousness of the consumers are duly considered to meet the inside and outside market demand[6].

Table 2: Evolution of the area covered by varieties [7]

Varieties	Area (percentage of total rice)					
	Year/sowing season					
	Nov 2005		May 2006		Nov 2007	
	Small farms	Large farms	Small farms	Large farms	Small farms	Large farms
ADRON-102	0.7	0	0	0	0	0
ADRON-111	56.5	37.5	36.7	23.8	26.1	26.1
ADRON-117	0.0	7	2.1	3	0.0	5.2
ADRON-125	31.3	26.7	57.0	47.4	63.5	45.3
ELONI	0.7	0	0.0	0	0.0	0
GROVENI	4.1	10.7	0.7	13.5	1.7	16.4
FERRINI	0.0	6.7	0.0	12.3	0.0	1.8
Others	5.8	11.4	3.5	0	8.7	4.4

The above table confirms the success of ADRON-125 and the resulting decline of ADRON-111. It shows also that ADRON-117 experiences some difficulties in the diffusion. Finally one can notice that older varieties are still popular and even more with larger farmers. The latter could find an explanation in the fact that large farmers are usually also millers and they do not fear to have their production depreciated. This also means that there is a market for that lesser rice quality.

The table below gives a description of the varieties' characteristics and will help in understanding the varieties attraction and distribution.

[4] Source: breeding and seed production system at ADRON, Dr Kanailal Pande July 2008
[5] Idem
[6] idem
[7] idem

Table 3: Characteristics of most used varieties [8]

Characteristic		Varieties		
		ADRON-111	ADRON-117	ADRON -125
Agronomy	Duration	113	113	100
	Plant height (cm)	100	96	97
	Average yield (ton/ha)	6.1	6.7	5.3
Morphology	Awns	Absent	Absent	Absent
	Stigma colour	Purple	White	Purple
	Foot colour	White	Green	Purple
	Leaf colour	Dark green	Dark green	Green
	Leaf stand	Erect	Erect	Erect
	Leaf aspect	Glabrous	Rough	Glabrous
	Kernel colour	Purple	White	Purple
	Aroma	No	No	No
	10-50% flowering	74-80	72-78	52-58
Grain	Length of grain (mm)	10.6	11.0	10.6
	Length of brown rice (mm)	8.1	8.3	8.4
	Width of grain (mm)	2.6	2.3	2.7
	Width of brown rice (mm)	2.3	2.0	2.2
	Thousand grain weight (g)	30	26.4	32.5
	Total white rice (%)	68	65	70
	Head Rice Yield (%)	43	46	55

However, ADRON-117 is a higher yielding variety, and has apparently other qualities like a better resistance to neck blast, but its diffusion is restricted by the grain characteristics. It is especially the grain width giving a lower Head Rice yield that seems to be the main reason for its lower success.

On the contrary ADRON-125 has quickly overtaken all the others. It is a short duration variety which gives more time for land preparation and is less subject to water problems. It requires less labour especially in fertilizer application as the total quantity is split in two passes against three for the others. Finally the grain shape gives a good HRY as well as a TWY.

[8] Dr Pande, Robert Elmont

4 SEED PRODUCTION STATUS AND PERSPECTIVES

4.1 SEED PRODUCTION ORGANIZATION

The seed production is managed entirely by the ADRON research station. The multiplication scheme is based on the OECD system. It comprises of four (4) classes of seed:

1. kwekerzaad (first generation),
2. elitezaad (second generation),
3. origineelzaad (third generation) and
4. eerste-nabouwzaad and tweede-nabouwzaad (fourth and fifth generations).

In Table 4 an overview is given of the relationship between the nomenclature used in Suriname compared to that of the OECD and the AOSCA.

Table 4: Nomenclature used in seed industry

Generation	Suriname	OECD	AOSCA
first	kwekerszaad	pre-basic seed	breeder seed
second	elitezaad	basic seed	foundation seed
third	origineelzaad	certified-1 seed	registered seed
fourth	eerste-nabouwzaad	certified-2 seed	certified seed
fifth	tweede-nabouwzaad`	commercial seed	commercial seed

The total ADRON land area is about 20 ha and presently the distribution is as follows:

- breeding and experiments 3 hectares;
- basic seed production 7.8 hectares;
- and the rest is dedicated for crop management tests and buildings.

For the production of breeder seed a number of panicles (between 100 and 500) are selected to constitute the parental material. From that material the best kernels from the best 200 to 300 panicles are selected for sowing (panicle to row method). Production of breeder seed is done through transplanting in rows 10 to 15 seedlings coming from the above chosen panicles on an area between 150 to 200 m^2. After due rogueing during growth, the harvest will be about 50 kg.

The breeder seed will be also multiplied by transplanting 1 to 3 seedlings per hill to produce basic seed. The quantity of breeder seed needed is therefore very small, 8 to 10 kg per hectare. The yield is approximately 3.5 to 4 tons per hectare. This can appear low but is the result of strict rogueing. This rogueing has an especially heavy impact as the main problem is the red rice and the fact that the plants surrounding that weed will also be uprooted to eliminate plants that could be contaminated through cross pollination.

The certified-1 seed is not produced directly on ADRON fields but following two different systems. ADRON can rent farmers' land and have its own production or sell the basic seed to contracted farmers and buy the certified-1 seed they will have harvested. ADRON will then dry and process the seed and sell it for further and last formal seed multiplication.

Finally, the certified-2 seed is produced by contracted farmers. ADRON will select farmers that meet a series of criteria and that will be provided with certified-1 seed. ADRON staff follows seed growers' fields to ensure that the production standards are met up to the harvest. Then the farmers are responsible for the sale of their production.

4.2 SEED PRODUCTION REALIZATIONS

Figures show that a significant increase has taken place in seed production and this has spectacularly accelerated in the last seasons.

Table 5: Seed production area and seed growers evolution [9]

1st season (Nov 2006)		2nd season Nov 2007		3rd season May 2008	
Nber Growers	Area (ha)	Nber Growers	Area (ha)	Nber Growers	Area (ha)
51	455	71	543.5	94	921

Table 6: Evolution of seed classes production [10]

Basic seed

Variety	1st season		2nd season		3rd season	
	Area (ha)	Production (kg)	Area (ha)	Production (kg)	Area (ha)	Production (kg, estimates*)
ADRON-111	1.8	3,850	1.6	5.,90	1.6	5,600
ADRON -117	2.4	6,965	1.4	6,125	1.5	5,250
ADRON-125	2.5	7,455	2.5	7,025	2.6	9,100
Total	6.7	18,270	5.5	18,840	5.7	19,950

Certified-1 seed

Variety	1st season		2nd season		3rd season	
	Area (ha)	Production (kg)	Area (ha)	Production (kg)	Area (ha)	Production (kg, estimates*)
ADRON-111	16.4	74,470	16.4	96,950	16.4	82,000
ADRON-117					26.0	130,000
ADRON-125	5.0	25,780	17.6	84,995	17.6	88,000
Total	21.4	100,250	34.0	181,945	60.0	300,000

Certified-2 seed

Variety	1st season		2nd season		3rd season	
	Area (ha)	Production (kg)	Area (ha)	Production (kg)	Area (ha)	Production (kg, estimates*)
ADRON-111	154	909,524	177.7	1,057,492	270	1,485,000
ADRON-125	270	1,591,920	365.8	2,102,252	621	3,415,500
Total	424	2,501,444	543.5	3,159,744	891	4,900,500

(*) Next harvest estimates (September 2008) based on average yield of:

- basic seed 3.5 tons per hectare;
- Certified-1: 5 tons per hectare
- Certified-2: 5.5 tons per hectare.

[9] Activity report on seed production, July 2008 Summary

[10] idem

In fact, it is the production of certified-2 seed that will have almost been doubled in three seasons. According to the usual seeding rate, the quantity produced is adequate to fully cover the current needs of all the paddy farmers. It is even superior to those requirements. The total area cropped per season is of about 20,000 hectares and the seed used per hectare is slightly below 200 kg. A total of 4,000 tons of certified-2 seed would than be sufficient to fulfil the entire demand. However, we should also keep in mind that not all farmers use fresh seed every season.

Several facts will explain that though the seed production is above the supposed needs there is still only a portion of the fields that are cropped with that seed. In addition, it appears that the quality is not as good as it could or should be.

Seed processing equipment is extremely limited in Suriname. In fact, presently there are two machines located in ADRON. Even with the improvements brought by the seed component of the EC project, the present capacity (including drying) will enable to treat about 1,000 tons of seed per season. This means that it will be sufficient for the basic seed only. With the extension of the drying capacity, the station could process a small portion of the certified-2 seed. In fact the constraint will also be the time available. The period between the two seasons is very narrow and does not permit to process more than 1,000 tons. Such a quantity will require at least two or even three months, depending on the working hours per day.

The result is that the seed used by the largest part of the farmers is not processed. As mentioned, it is usually bought from seed growers' fields. And everyone will take care of his own seed. Generally, it will be sundried but cleaning is felt not to be of primary importance. For sowing, farmers use pre-germinated seed and when they soak the seed in bulk the light material floats and is removed. In fact, this way of cleaning will only eliminate a part of the impurities but heavier material remains.

Drying is rarely done and when it is, the farmers use the millers' facilities. Those millers do not have special equipment to process the seed. Therefore, this system is the cause of quality losses. As the millers will use the same dryers and cleaners that they use for the paddy, the contamination by other seed and by weeds is common.

In absence of drying and cleaning facilities, it can be assumed that the seed used by the majority of the farmers, even that certified-2 seed produced under the seed multiplication programme has poor germination quality. Rice seed very quickly loose their germination ability if not dried immediately after harvest.

Table 7: Criteria for the different seed classes

characteristic	Basic seed	Certified-1	Certified-2	Commercial
purity (%), maximal	98	98	98	98
red rice (#/kg), maximal	0	2	5	10
moisture (%), maximal	13	13	13	13
germination (%), minimal	95	90	85	85
inert matter (%), maximal	2	2	2	2

In table 7 the criteria for the different seed classes is presented. These criteria were adopted by the Nationale Zaadraad (NZR, the National Seed Council) in its meeting of 6 April 2004.

The data available collected by ADRON's laboratory show that the quality of the seed drops very significantly from one generation to the following. The problem assessed was the presence of red rice grains in cleaned seed.

Table 8: Number of red rice grain in 500 g sample in basic and certified-1 seed[11]

Variety	Number of Red rice			
	Basic		Certified-1	
	1st season	2nd season	1st season	2nd season
ADRON-111	1	0	3	3
ADRON-117	0	1		
ADRON-125	1	0	2	2

It is very important that even in the basic seed the red rice infestation is present. This is extremely worrying because the standards prescribe that in that generation no red rice should be found. In the same way the standards are not met for the certified-1 seed.

Table 9: Number of red rice grain in 500 g sample in certified-2 seed [12]

Variety	% area		
	1st season	2nd season	Number of red rice kernels
ADRON-111	41	48	<5
	0	33	6-10
	21	8	10-20
	38	11	>20
ADRON-125	5	62	<5
	25	24	6-10
	53	11	10-20
	17	3	>20

In the production of certified-2 seed, the standards would demand that the number of red rice grains be below 5 per 1000 g. The tables above show that the majority of the seed does not meet the standards.

It is very important to further analyse the figures reported. The problem of red rice is that, nearly everyone among the sector stakeholders considers it as the most critical. The weed is difficult to tackle and reduces dramatically the yield in quantity as well as in quality. The red rice is also a very important factor downstream in the rice chain. At milling level it will reduce the head rice yield and moreover the white rice quality and value.

It is then particularly vital that the first stage of the paddy production, sowing, be made using the best possible material. Everything should be put in action to avoid field contamination by the seed itself using a product free of any weed grain. Red rice is shattering and will multiply extremely rapidly.

[11] Activity report on seed production, July 2008 Summary
[12] Idem

Regarding the availability and supply, it was seen that the quantities produced are above the total current requirements. One could then think that all the Surinamese paddy producers use new seed of improved varieties. In fact like there is no processing centre, there is either no marketing or distribution system for certified-2 seed. Only few farmers buy their seed from organised seed suppliers. These can be some millers or more rarely a farmer that is specialized in seed sale. The majority uses its own saved seed or buys from the neighbour.

In those conditions it is obvious that the number of farmers reached by each seed grower is relatively limited. In addition, the seed growers are not all, especially eager to sell their production. Many of them are essentially multiplying seed for their own use and if possible the remaining can be sold when he finds immediately a buyer, before or during the harvest. If this is not the case, the seed will be delivered to the mill and usually handled as normal paddy. The seed should be dried and processed without delay, but without any proper infrastructure and equipment, the seed grower has to dispose of his production right from the field. Many farmers might have joined the multiplication system to obtain high quality basic seed or certified-1 seed and multiply for their own use.

The price is also a major constraint. For the certified-2 seed, the seed grower would ask 10 to 15 percent more than the paddy price. But the farmers are not ready to pay that bonus because the seed quality is not very different from that he can obtain himself (no drying nor processing). Then, at field gate the seed is sold with a small premium of maximum five percent.

As the seed unit in ADRON is aware of that situation, the staff has increased the number of seed growers. In order to improve the seed diffusion the seed growers are spread over the polders with the objective of covering a bigger area and trying to enable a larger number of paddy producers to benefit from better seed.

In conclusion, one can say that the quality of the seed reaching the final users, the paddy producers, is not of sufficient standards. Variety selection has released very quickly four or five varieties that have very distinct and appreciated characteristics. There has been a constant progress in the field and milling yields. Both farmers and millers have generally appreciated those characteristics. The main advantage actually procured by the current seed multiplication scheme is to disseminate the improved varieties to the largest possible number. But the seed can provide much more than only that variety spread.

Even if this is already a great achievement, the benefits that should guarantee the use of improved quality seed is not completely obtained. It is generally recognized that the use of good quality seed of the same variety can result in a yield increase between 10 to 20 percent without any other change in inputs or management practices. The Surinamese rice production can be a very good example of that. The consultant did not conduct a formal survey but crop aspect and expected yield observed or those reported by the farmers during the field visits corroborate the above statement. The average national yield is presently above 4,000 kg per hectare when the varieties have a potential yield of about 6,000. During his field visits, farmers reported yields reaching more than 8,000 kg and it was also possible to

observe that kind of fields. Even if the seed is not the unique element responsible for those successes, it will have highly contributed.

Most of the farmers met are fully aware of the profits they can obtain from the use of good quality seed. And for the majority of them, the price is not a determinant factor. The price of the seed is very variable. When it is purchased wet from the field, the producer tries to obtain 10 to 15 percent above the paddy price but that is not always possible and generally the premium is only about five percent. When it is dried and cleaned through millers of with self-made machines, it is sold at 40 to 50 percent more. This last price might not be completely justified by the seed quality or by additional costs incurred by the producers. However, as there is a demand that seed is easily sold and farmers are actually ready to pay to obtain seed.

The price of basic seed is decided according to production costs. Last season (May 2008), it was set at more than the double of the price of paddy (when it was settled). The difference decreased progressively because it was not adjusted when paddy prices were soaring. This is another evidence that farmers are ready to pay for good seed at the right price when the quality justifies it. Even the certified-1 seed is easily sold and not only to seed growers. Normal farmers are impatient to purchase that class of seed even if the cost is high.

The seed demand was assessed by a consultant, Hendrie N. Karijoikromo, in December 2007. The consultancy report mentions the price the large and small farmers would be willing to pay for the seed. In fact this might be the price they are willing to pay for the current seed given the quality it has. But the market of certified-1 seed and basic seed would confirm that if the quality improves they would pay more.

Indeed, the experience shows that the main reason to buy seed (apart from his own farm seed) is the yield improvement it can bring. This yield increase can result from the change in variety but also the particular quality the seed itself has or the advantages it provides. These are, in addition to the genetic purity, the specific purity (the percentage of rice grains), the germination rate (the percentage of grains that will give a viable seedling).

The seed price must then be looked at with those characteristics and compared to the farmers saved seed.

The agriculture of Suriname can be compared to that of Western Europe: large or very large farms, fully or hyper-mechanized using large quantities of inputs. In that case, and especially in rice, the amount of seed used is big. The labour required to save his own seed is considerable. It is necessary to harvest separately. Drying requires heavy or expensive handling. Storage is sometimes difficult even if it is usually short. Finally it has to be cleaned.

The cost also has to take into account the final respective value of each product. If the seed is of higher purity (less weed, stones, straw…) and has better germination (more and stronger seedlings with the same quantity), the use of improved quality seed can be cheaper than the farmers' saved seed. The table below shows how certified seed can improve field installation without extra costs compared to farmer's seed.

Table 10: Comparison between farmers' seed and certified seed

Seed type	Specific purity (%)	Germination (%)	Seed rate (kg/ha)	Seedlings ratio	Relative cost
Farmers' seed	90	70	200	126	200
Certified seed	98	98	140	134	196

The table above demonstrates that the certified and processed seed can be financially advantageous. In this example, the price of the certified seed was set at 1.4 times the cost of the farmers' seed. It should also be considered that no cost was taken into account for all the expenses and burden the farmers' seed carry. In conclusion for price slightly inferior the farmer would use less seed and obtain a final number of plants per hectare that is higher (seedlings ratio).

But all the above argument is only valid if the certified seed is really of good quality. In Suriname's rice sector today, seed available to farmers for paddy production could not be called seed or more precisely good quality seed. The only product that is approaching to that is the certified-1 seed. It is the only seed that is dried and processed properly. It is also why farmers are so interested in obtaining it even if the price is higher. But the certified-2 seed is not very different from what any farmer can produce himself. Without improvement of the entire chain and especially the last stage of seed sold to farmers, it might not be possible to build a sustainable seed industry that would help improve the entire rice sector.

Seed is not only meant to increase yield and farmers' incomes. The effects of the usage of better quality seed will help improve the milling yields and the quality of the final product, the white rice reaching the consumer.

Milling yields depend on several factors of which the quality of the raw material is the most important. Whatever the performance of the equipment and the management capacity of the millers would be, the output cannot be good if the material used is of poor quality. Of course, millers are aware of that and some of them try to have an influence by paying a premium for cleaner and purer paddy. Some will only buy paddy of a specific variety.

Suriname does not have standards for paddy and does not have a paddy classification system either. But in the current situation it is not sure that without a clear and strong policy on behalf of the government such tools would help. Given the high rice demand and raising prices as well as the competition between millers that have to make their enterprises work, it is not sure that anyone would apply the rules.

4.3 SEED PRODUCTION RE-ORGANIZATION

Seed production is presently organized in order to meet high certification standards and enable fulfilling the farmers' needs. It was shown above that the quantity produced should be sufficient to satisfy the requirements for the entire rice cropped area. In the same time it is certain that all the farmers do not use certified seed. This is due to various factors and the

seed production and distribution performances should be increased. Farmers' access to the seed and first of all, the quality must be enhanced.

Improving seed quality can be done through different means. In fact what needs to be improved are the genetic purity and the physical and physiological characters. The first is related to actions to be taken at field level and two last depend on processing.

In the case of rice and in Surinamese conditions, the genetic purity is mainly what in other situations specific purity is. The presence of red rice in the fields and in the seed is not so easy to avoid as the weed has the same aspects both as plant and grain. It is therefore important that opportunities of infestation are reduced. This can be achieved through the use of cultural practices.

In a seed multiplication process, contamination by red rice can only originate from the field or the equipment. In pre basic seed, rogueing has eliminated any off-types and no red rice could be found in that class. It is then later, in the following generations that the risks exist. In addition to some techniques described later it is very important that the multiplication fields are carefully selected according to those criteria. In Suriname where sowing is done by airplane the risk of seed being dropped in multiplication fields are important. The fields should be chosen in areas out of normal flying routes.

In addition the equipment must be cleaned carefully before each usage especially when other varieties or generations have been worked. This is true for all land preparation tools but of primary importance for the harvester. It usually contains a large quantity of seed and can be the principal source of contamination.

This point is to be stressed, as the ADRON seed unit does not have much equipment. It has to rent the combine and cannot always impose a sufficient cleaning because of the time required and the cost involved for the owner. It is of particular importance that the seed unit be equipped with its own equipment.

The other occasion to cut the chances of contamination is to reduce the number of generations. In the case of Suriname the total amount of commercial seed for an individual variety is extremely limited and the multiplication rate is excellent especially when transplanting is used, 10 kg can give 5,000 kg (multiplied by 500). This means that if the quantity of pre basic seed is increased the basic seed would also increase and would be adequate to sow an area that would produce enough seed to satisfy the demand in each variety. To obtain about 100 kg of pre basic seed it would be needed to double the number of panicles (rows) in the first generation.

Table 11: Quantity of seed and area needed in each seed class

Total rice Area (ha)		Certified		Basic		Pre basic
		Quantity (t)	Area (ha)	Quantity (t)	Area (ha)	Quantity (kg)
All varieties	20,000	3,500	700	98	28	280
Per variety	7,000	1,225	245	34	9.8	98

The table above gives the details of the quantity and area needed for each generation of seed.

This means that only one generation of certified seed could give enough seed to fulfil the needs of all farmers. In fact if the total quantity required for the current rice area of 20.000 hectares is of about 3,500 tons, an amount of around 1,000 tons is sufficient to satisfy the requirement for one specific variety.

Regarding the responsibility of the implementation of the seed multiplication and supervision it is obvious that there is a need for an evolution towards more implication from the private farmers but particularly ADRON should progressively renounce to the execution of the production.

The mission of ADRON is selection and research. It has been accomplishing that task with great success. The varieties released in the succession of ADRON lines are especially well performing in terms of field yields as well as in milling and white rice quality. Unfortunately ADRON's involvement in the seed multiplication might have absorbed part of the potential as the efforts were focussed to achieve the production objectives set.

The research station was certainly the most suitable to realize the tasks foreseen as part of the EC supported project. ADRON financial and especially human resources are extremely limited and have been concentrated to the seed multiplication objectives. This might have negatively affected the breeding activities. To illustrate this one could consider the size of the Pedigree Nursery plot in 2005 and now. The Pedigree Nursery is a crucial part of the breeding programme. The larger the pedigree nursery plot, the bigger chances are for selecting a good variety. In 2005 the Pedigree Nursery plot was approximately 15,000 m^2, almost half of the total area reserved for breeding experiments. In 2008 the Pedigree Nursery plot shrunk to hardly 1,000 m^2. Indeed, a very alarming situation.

In terms of quantity, the objectives are met but the quality of the seed reaching the farmers must improve. It is especially regarding the organizational aspects that the achievements are fragile and will need more support. The seed growers association is in place but it looks at least fragile or a little artificial even if some of the members are very interested and active. The association is composed of certified-1 and certified-2 seed growers and is the weak link of the chain. They do not have much to share. In fact, each grower is isolated when it comes to the sale of his production. One can wonder if the participation in the association is not mainly the condition to benefit from the small financial support provided through the project but above that it guaranteed the possibility to obtain better quality seed that was of higher purity, dried and cleaned.

It was expected that the millers would process the certified-2 seed. One can anticipate that as they already have equipment that is very similar and follow the same type of routine, they would engage in the seed business. But seed processing requires specific care to avoid admixture and ensure quality. In addition, it comes at the same time as the paddy that is the principal object of the millers' activity.

To ensure the best quality, the raw material should be delivered in a separate receptacle and follow a specific route up to the end of the process. Drying must be more careful, the temperature cannot be more than 40 °C. In conclusion, this option, which looks very interesting, would demand that millers would consent some significant investments in terms of finance but also in management.

Presently, it is not clear what the plans are for the future developments of the seed industry. ADRON is conscious that it is not its role to further be involved in seed production. With the Seed Growers Association they are trying to develop a genuine seed enterprise that would be able to process the entire volume required for the rice sector (4,000 tons).

As pointed out earlier, ADRON is the unique breeder and in the short and medium term, it will remain so. The breeder is responsible for the production up to the basic seed. This means that he must supervise that the maintenance is properly conducted to ensure that the seed meets the standards. But it is not necessary that the physical production be done by ADRON.

In the scheme outlined above with three generations (pre basic, basic and only one certified seed) it would be recommended that ADRON concentrates on the production of pre basic seed. The rest of the multiplications, the basic seed and the last generation (certified seed) could be in the hands of private farmers.

ADRON has invested in equipment and infrastructures (dryer and building) to process the basic and certified-1 seed. If this solution were maintained, some reforms would be required. The seed production unit should be completely independent from the research activity. Many examples have proved that the production by the public sector is usually non-profitable and the sustainability extremely unlikely.

The creation of an autonomous Seed Unit within ADRON should only be a transition solution. Quickly the entire production should be handed over to the private farmers.

It is envisaged:

1. the creation of an independent leg within the foundation SNRI, at the same level as ADRON. This one would be responsible for the production of basic and certified-1 seed (in the present scheme);
2. the building of a semi-public Seed Enterprise (participation of ADRON or SNRI, and of private farmers).

Several points have to be carefully examined:

- financing (bank loan);
- profitability.

In the proposed plan[13], the enterprise capital would be in the shape of 1,000 shares of SRD 1,000 held by the Seed Growers Association (26%), SNRI (25%) and other

[13] Aanvulling businessplan voor opzet van een zaadverwerkingsbedrijf voor padie, A.W. Graanoogst, July 2008

stakeholders (49%). It is projected that a bank loan will be obtained for 80% of the total capital.

The business plan describes that with an output of 2,830 tons per season sold at 1.5 times the price of the raw material the profitability is ensured. No doubt, that as described the enterprise looks viable. In fact the machines foreseen are of large capacity (about 4 tons per hour), which fully justified for the dryer, as the product must be dried as soon as delivered. But the cleaning could be done on a longer period of time. In the conditions of Suriname where the time left between two successive seasons is not more than two months, it is not sure that the entire sequence of processing (including quality control and certification requirements) can be envisaged in that interval. It might be more advisable to study the options consisting in using smaller capacity cleaning equipment and extending its working time. In that case the seed harvested in one specific season would not be sown for the following crop but only about six or seven months later. It means that the storage capacity should be increased for the dried and unclean seed as well as for the processed and bagged seed.

5. QUALITY CONTROL AND SEED CERTIFICATION

5.1 PRESENT SITUATION

As it was described earlier, the seed production system is completely supervised by the REMUS through the seed production unit set up in ADRON. It has accomplished a remarkable work with the assistance of the EC project even if there are many links that remain fragile. Regarding the aspects of quality control it is again ADRON and more precisely the seed component that fulfils most of the responsibilities.

A quality control body, the Seed Unit is in place at the Ministry level in Paramaribo. It is officially in charge of the quality control of all the seed sector in Suriname including inspections and laboratory tests. In fact the Seed Unit does not have the capacity to fulfil its duties. Finance and equipment are not sufficient.

The most evident deficiencies are at the following levels:

1. Laboratory
   First of all the building and facilities available are insufficient and not suitable for a seed laboratory. There are only three rooms in total and only one room can be devoted to conduct all the tests. In addition:
   - There are no suitable probes for bag sampling. Those available can only be used for bulk lots.
   - No moisture proof bags, suitable oven, and balance for moisture content analysis;
   - No proper tools and instruments for specific purity determination;
   - No de-husker for red rice count;
   - No proper equipment for the germination test. The germination cabinet was never used.
2. Personnel
   The Seed Unit staff is composed of four persons: the supervisor, the laboratory analyst; the inspector and a administration officer. It is obvious that this is not sufficient. Besides, the staff would need training to improve its competences.

In terms of operations, it is also clear that the seed unit cannot carry out the tasks it should. It would be necessary that the staff travelled permanently to conduct the fields inspections and for the sampling. Currently the controls are therefore limited and concerning the rice seed production, they are conducted by ADRON staff. Here too, the same comments as above can be made concerning the staff and equipment. In conclusion, the seed quality control is almost not operational.

On the regulatory side, the Seed Act and other rules have been prepared but are not yet enforceable. The entire seed sector is then working on mutual agreement. On the other hand, if the rules were to be fully implemented, there would not be any seed that could be sold, as they do not meet the standards. However, the seed industry performances need to improve if one wishes to develop the rice sector's competitiveness. Seed quality control is not only

necessary to ensure that the seed produced is of better quality for the only sake of having good seed but, because seed of better quality guarantee that with due cultural practices the farmers can reach the maximum potential yields of a crop.

Suriname intends to implement a seed certification system. According to the Seed Act, the certification will be in line with the OECD seed systems. In that aim a series of tools are to be installed.

In fact, a complete seed certification system should comprise the:

- variety DUS and ATV testing service according to international standards;
- variety official registration and national catalogue;
- design of a multiplication and maintenance scheme;
- field inspection service;
- seed sampling and laboratory testing following ISTA guidelines;
- bagging and labelling;
- post controls;
- seed law and the associated rules and regulations for the implementation of the seed multiplication and trade of with appropriate standards;
- prescribed methods for the control at each step of the seed production and trade.

An official body (the National Seed Council) conducts the supervision and coordination of the entire process. It is generally chaired by the Ministry of Agriculture and composed by representatives of the agricultural sector (including research, breeders, certification service, seed growers, farmers, traders and millers).

Presently, none of the above requirements are fully in place. In fact, only the Seed Act and rules are well advanced. The Seed Act was published in May 2005. The regulations have also been prepared and are in the promulgation process. The Breeders' rights protection law has been drafted and is being discussed with experts from the Ministry of Justice. After incorporation of the comments of the Ministry of Justice, the draft Act will be submitted to Cabinet for approval. After approval the State Council will also gives its opinion. It will then be submitted to parliament for approval and finally endorsed by the president. So there is still a long way to go. One would say that the technical part of the work is completed and that the ball lies in the political hands.

The implementation of the seed certification scheme will demand a clear engagement from the government. The development of the seed industry and of the rice sector (as well as of the entire Surinamese agriculture) will partly depend on the support the certification scheme will receive and how it will be enabled to fulfil its role. Seed certification is a service that is generally under the responsibility of the Ministry of Agriculture.

In the case of Suriname it is impossible that the private sector could bear the cost related to the functioning of such a Service. The size of the agricultural sector is too small to imagine it could pay for all the undertakings.

5.2 PROPOSED EVOLUTION TOWARDS SEED CERTIFICATION

If it is agreed that the seed production and the rice sector cannot develop without a strong framework to protect all actors involved, it should also be taken into account that Suriname's agriculture cannot afford a full certification system. The design of that scheme has to be scaled down but each component must be available. Below a sketch of the recommended system is described.

5.2.1 Variety registration

Before a variety is released and the breeder allowed starting the seed multiplication for commercial purpose, it must meet a number of criteria and pass through a series of tests. The breeder will submit a sample of parental material with a precise description of the variety to the Certification Service to check that the variety is:

1. really distinct (Distinctness),
2. is really a variety and that all the plants have the same characteristics (Uniformity) and
3. that the characteristics are kept unchanged during successive generations when the maintenance scheme defined by the breeder is used (Stability).

Those checks are conducted during at least two seasons and before a new breed is released or a variety is imported.

The variety will also be tested for its qualities, in the field and in its use or processing. In the case of rice, those characteristics will be the yield, the resistance to pests and diseases and also the milling properties and marketing potentials.

In the OECD seed systems, the description mentioned above, is prepared following specific guidelines published by UPOV and used also for international breeder's rights protection.

The results of those tests will be submitted to the National Seed Council that will decide whether it can be released and multiplied for the agriculture. When the decision is positive, the variety is then registered in the National Catalogue.

In Suriname, variety release is very simple and decided without much coordination and consultation. The National Seed Council is in place but the decision might be limited to the approval of ADRON conclusions. There is no National Catalogue and the description is not exactly what it should be.

To meet the certification requirement it is necessary to implement the missing steps:

- for the description, the UPOV descriptors should be used;
- the DUS and ATV tests should be conducted.

In Suriname, there is currently only one breeder, ADRON, and it might be so for the medium term too. It would be recommended that ADRON be responsible for the implementation of the DUS tests. In the same time the varieties descriptions have to be resumed using UPOV descriptors.

As ADRON would be the breeder and represent the certification agency the same plot could be used for the production of pre basic seed and for the description. This would enable to save time and funds.

5.2.2 Maintenance Scheme

The maintenance scheme is meant to use cultural practices that will ensure that during the successive multiplications, up to the moment the seed reach the farmers for commercial production it carries the original characteristics.

In the case of rice there are no special conditions and the scheme presently used is fully suitable. The only remark would relate to the basic seed production where several seedlings are transplanted in the same hole. This is not justified and even conflicting with the requirements because the plants have to be inspected individually to identify the off-types. In addition, it is also a waste of seed.

5.2.3 Field inspections

The field inspections are conducted to check that the standards set for the crop implementation and management as well as the genetic purity are met. They will ensure that the seed grower is registered, uses a suitable seed and that the field meets the requirements.

The inspections are conducted by duly appointed personnel. They are usually government staff, without any relation with the production and that will have received the necessary training.

As mentioned, the corps of inspectors comprises only one person based at the Seed Unit in Paramaribo. She has no proper training and no means to execute her duty (transport). At the same time the area to be inspected is relatively huge (for one inspector). The inspections are therefore mainly conducted by ADRON staff that is directly involved in the production. The control cannot be considered fully independent. In addition there is no specific agreement or real coordination with the Seed Unit based in the ministry. Seed inspections are conducted independently by ADRON.

The solution is then to increase and train and better equip the staff of the Seed Unit. But in the same time, the inspections require a large number of personnel and are also concentrated in short period of time. Even if the inspectors could be in charge of the seed sampling after processing, there will always be a period when they are inactive. As a consequence, their function must couple with others tasks. The best would be that they could also work as seed samplers and in the laboratory as analysts. Those operations take place later and are also concentrated on an intense but short period of work.

5.2.4 Laboratory

The laboratory tests are intended to ensure that the seed harvested, processed and ready for marketing encounters the criteria set by the regulations. They are: the specific purity, the moisture content and the germination rate and vigour. A complete set of tests should include the health testing for seed borne diseases.

Presently none of those checks are fully satisfactory. Even the most important, the germination rate cannot be completely trusted as the conditions in which it is conducted are not in line with the prescribed methods.

The Surinamese Seed Act specifies that ISTA rules and guidelines will be applied. They are those used at international level. To be able to meet ISTA norms it will be necessary to completely reshape the laboratory setup. That means that in the building, at least three rooms will have to be reserved for the tests (1- sample reception and moisture content, 2- Specific purity, 3- germination) an additional room would be needed to store the samples after analysis. It is also necessary to plan sufficient space for the supervision and administrative staff.

The laboratory is generally considered as the most important component of the quality control service. It is managed by an agronomist with large experience and specific training and experience. When the seed has been tested in the laboratory and receives a positive "seed analysis certificate" it means that all the steps for certification were successfully passed:

1. the seed was obtained by sowing an approved mother-seed of a registered variety,
2. the crop was conducted by a registered grower, on a field meeting the standards and
3. finally the physical and physiological characters meet the minimum requirements.

The laboratory must have access to all the preceding information related to the history of the seed the sample represents. This leads to the previous chapter concerning the staffing of the inspection. It is obvious that the best and cheapest way to organize the quality control service is to group the seed growers and traders registration with the inspection and with the laboratory. The staff will then be fully occupied throughout the year. It should start with the seed growers and seed fields registration (also valid for the seed processors and traders), later conduct the field inspections, draw samples of seed batches ready for marketing and finally analyse the productions and deliver the quality control certificate.

The final stage is the delivery of the labels. In a certification scheme, when a label is apposed on a bag it means that the content has fulfilled all the requirements. The users are then assured that they can trust the product. This completes the seed certification system. It is also the laboratory that should be responsible for the delivery of the labels. In addition to the shape, colour and mentions, the labels must also be registered and numbered and the seed grower, processor or trader will receive only the number of labels corresponding to the quantity declared from which the sample tested was drawn according to the number and size of containers.

For the international trade, the laboratory must have received the ISTA accreditation. The process is long and lasts at least three to four years. It consists essentially in passing a kind of examination. The candidate laboratory will have to analyse a series of referee samples. Finally the functioning of the various steps of the certification scheme will be checked, the facilities will be inspected and the personnel capacity tested.

5.3 FUNDING THE SEED CERTIFICATION SCHEME

As mentioned earlier, it is not sure that due to its size, Suriname's agriculture and seed sector can afford a complete seed certification system unless the Government will support a larger part of its funding. Usually taxes on agricultural activities and fees for services will enable to run the scheme. In the situation of Suriname the investments needed for personnel, equipment and infrastructures are not so different than those for a large-scale agriculture but will only serve a very limited number of farmers and traders.

For the moment, most of the service rendered by the quality control are free of charge. In the same time, the situation of the funding will not really change if they were to be paid. In fact, it is only some of them that could be charged: the registration as seed grower or traders, the field inspections and the laboratory tests. Even those activities could not be entirely endured by the clients.

The government will have to support a substantial portion of the budget required for the major part of the activities. The most important are:

- the registration of varieties and the updating of the National Catalogue;
- the training of the field inspections and part of their operational costs;
- the housing, equipment and part of the functioning of the laboratory.

The laws and regulations prepared would not be of any use and could not be enforced if some prerequisites were not put in place. They are particularly the affiliation to the major organizations namely the UPOV and ISTA. The first is related to the breeder's rights protection and the latter for all what regards seed testing.

6 CONCLUSION AND RECOMMENDATIONS

6.1 CONCLUSIONS

The seed supply was never sufficient to meet farmers' needs. Since the collapse of the government enterprises the situation became worst and farmers have been using their own production of relatively old varieties. As the availability of good quality seed was always very limited, farmers were accustomed to the use of relatively poor seed resulting in poor yields in the field and at milling level.

Since 1994, ADRON has taken over both breeding and seed production. The institution has released new high yielding varieties meeting high rice quality standards. But the situation of the seed availability has not really improved even if the amount produced in the recent seasons with the support of the EC project has significantly increased and reached a level that would be satisfactory to cover the entire current paddy production area. In fact, the seed used by the paddy farmers remains principally their own saved seed. There are no precise data concerning the destination of the certified-2 seed produced but it is probable that the major part of it is delivered to the mill and processed like normal paddy.

The present organization lies entirely in the hand of REMUS and within ADRON that is involved and realizes the production and processing up to certified-1 seed. ADRON supervises and coordinates the entire seed multiplication. Its activity ceases at the sale of the certified-2 seed which is the responsibility of the seed growers. With the assistance of the EC project ADRON has achieved very important successes in increasing the quantity of seed available and in improving the quality of the material.

The certified-2 seed in not processed and is generally sold (when sold) directly from the combine-harvester. In fact, the seed remains of poor quality. The seed does not significantly differ from what the paddy growers can obtain himself. The farmers are more interested in obtaining certified-1 seed to multiply it for their own use. Apart from the drying and processing that is not operated, the major constraint about seed quality is the high percentage of red rice it can carry. Even the basic seed and the certified-1 seed do not meet the standards but the quality is extremely low in the last generation, the largest amount, that which reaches the paddy farmers.

The multiplication scheme used comprises four generations: breeder's seed, basic seed, certified-1 and certified-2 seed. The quantity required for each variety could be obtained through only three generations. The multiplication could stop at the certified-1 seed reducing the costs as well as decreasing the occasions of infestation by red rice.

The considerable involvement of ADRON in seed production execution and supervision might have distracted the organization from its primary responsibility, the research and breeding activities. In the same time the achievements acquired might be fragile after the end of the project support. The Seed Growers Association seems weak. The seed production methods

do not ensure a sufficient quality. The unique seed processing facility resides with ADRON and cannot dry and clean the last generation that reaches the farmers resulting in little advantage for the product. The envisaged seed processing plant is of large capacity and its outfit reminds very much of the past semi-public enterprises SML and others that were very costly, never profitable and have eventually collapsed.

The quality control is almost entirely executed by ADRON that is also fully involved in the production process. It is therefore not independent. The Seed Unit within the Ministry of Agriculture cannot fulfil its role because its budget is not adequate and it is poorly equipped and staffed. Therefore, even if the situation is not optimal, ADRON will continue to operate the field inspections.

The law and regulations are prepared and would be ready for promulgation. The remaining work is mainly in the hands of the government. Those laws and rules foresee the establishment of a seed certification system comparable to what in use in countries participating in the OECD systems for international seed trade. Agriculture the size of that of Suriname might not be able to afford such a scheme. Some adjustments might be needed but still keeping the same aim.

6.2 RECOMMENDATIONS

The main recommendations rise directly from the above conclusions. And in first position comes the improvement of the availability of better quality seed. The initial step will take place in the fields and consists in amending the multiplication scheme and improving the cultural practices to avoid the contamination by red rice. Instead of 4 generations 3 would be sufficient if the quantity of pre basic seed is increased. The paddy farmers would use certified-1 seed and in that case the chances to have red rice infestation are reduced.

The amount of seed required permits to reduce the number of generations. They could be limited to the certified-1 seed. In addition, ADRON should withdraw itself from the seed production and limit its activity to the provision of pre basic seed or maximum basic seed if it would receive the required equipment (e.g. combine-harvester).

Certified-1 seed could be the last generation of seed and should be given to selected farmers. Their fields would be of very good nature: levelling and management. The cultural practices should ensure the optimum quality and therefore include the use of pesticides and more precisely herbicides to eliminate any chances of red rice contamination.

The second stage will be implemented after harvest. It is indispensable to improve the physical and physiological quality of the product that is used by the normal paddy producers. In that aim, it is crucial that the seed be dried and processed. In Surinamese conditions it seems that two relatively small plants of 1.5 tons per hour could be sufficient if used efficiently. Such a machinery can easily process 1,500 tons in three months and would cost about € 100,000. This option would require the availability of storage facilities for the dried material and for the processed seed because it would not be used for the immediate following season. It would then be easier to enable sampling, laboratory testing and certification to operate.

The last recommendations relate to the regulatory matter and quality insurance devices. Once the seed production will be able to deliver a good quality seed it is important to ensure that the breeders, the seed growers, the processors and the traders are protected against fraud and that the farmers will always receive the best product available. The implementation of the seed certification system would help in achieving that objective. In that aim the Government will have to rapidly promulgate the laws and the rules that have been prepared by the technicians.

A full certification scheme is not realistic but with minor adjustments the system could fulfil its obligations. Those amendments would be in the best use of all available resources. The research could be responsible for the description and the DUS. The staff of the laboratory would also be in charge of the seed growers' registration, field inspections and seed sampling.

The ISTA accreditation for the Suriname seed laboratory would require investments that might be unaffordable and not really meaningful. But the affiliation to ISTA is recommended to participate in the referee test, improve the capacity and gain international recognition.

In the same way the full membership to UPOV, might not be necessary but above all too expensive but the participation as observer can be sufficient.

Finally, it is necessary to improve the expertise of the staff involved in the seed certification. Training at the master level would be recommended for the chief of the certification service. That responsibility should be given to the head of the laboratory. The personnel of the laboratory should also benefit from specific training (seed testing and field inspection). It might be advisable that the scientist responsible for the description and DUS be trained also in a specialized institution (seed certification agency).

Those improvements are vital if it is envisaged to develop not only the seed production but more generally the paddy production performance and finally the quality and competitiveness of Surinamese rice. Suriname has good varieties, relatively good water management as well-qualified and well-equipped farmers using reasonable amounts of fertilizers. Nevertheless the rice sector achievements remain low. Seed is not the panacea to solve all rice production difficulties, but the availability of enhanced quality seed will certainly improve the functioning, quality and finally the competitiveness of the Surinamese rice sector.

ANNEXES

ANNEX 1 : PERSONS MET

Kardie Kartosoewito	Director ADRON
Jerry R. Tjoe Awie	Coordinator National Rice Programme (9ACP RPR006)
Soedjat Dipoikromo	REMUS/Seed production
Gilbert Nojotaroeno	REMUS/Seed production
Esther Doelahasori	Head of Seed Unit
Jagdies Bhansing	Permanent Secretary Ministry of Agriculture
Liakat Mahawat Khan	Miller (CHARIN)
Soekardi Jodiwongso	Seed grower Western Polder
Trisno Kasanwirjo	Seed grower, Western Polder
Diabnapersad Bissesar	Seed grower and Miller, Eastern Polder
Othnil van Tholl	Seed grower, Eastern Polder
Soepandri Karsodimedjo	Seed grower, Miller
Narindernath Ramesar	Seed grower, Van Drimmelenpolder
P. Baidjoe	Farmer

ANNEX 2: REFERENCES

- Breeding and seed production system in ADRON, Dr Kainalal Pande, July 2008
- Good agricultural practices (GAP) bij zaaizaadproductie, N. Gajadin and L. Soerdjan, June 2008
- REMUS Workplan 2008
- Survey Report on the demand for seed by paddy growers, Hendrie N. Karijoikromo, December 2007
- Report on Survey of the availability of drying capacity for seed processing, Andre W. Graanoogst, December 2007
- Report Study on rice seed certification in Suriname, J. Wijngaarde, March 2007
- The Paddy seed supply system, L. Soerdjan, December 2007
- Study on the history of seed supply used by SML and PBP, March 2008, Ninon R. Cameron
- Activity report reseach and extension, 2008
- Aanvulling Businessplan voor opzet van een zaaizaadverwerkingsbedrijf voor padie, A.W. Graanoogst, July 2008
- Activity report on seed production, July 2008
- Activity report onseed production, November 2007
- ZaadWet, May 2005
- Zaadregelingen
- Zaadcertificeringsnormen
- Wet kwekersrecht (versie December 2007)