WARDA RESEARCH DEPARTMENT

1978 ANNUAL REPORT

WEST AFRICA RICE DEVELOPMENT ASSOCIATION, P. O. Box 1019
Monrovia - Liberia

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P R E F A C E

The West Africa Rice Development Association (WARDA) is an intergovernmental regional organization whose main aim is to make West Africa self-sufficient in rice production. The Association started to function on 1st December, 1971 and has 15 members: Benin, The Gambia, Ghana, Guinea, Guinea Bissau, Ivory Coast, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, Togo and Upper Volta.

The main policy making body of the Association is the Governing Council made up of one representative from each member state. A Scientific and Technical Committee, periodically reviews the Association's work programme.

The member countries contribute to the administrative budget of WARDA, while a multiplicity of countries and organizations finance the technical projects. The Consultative Group for International Agricultural Research (CGIAR) finances the greater part of research and research administrative costs.

The main objectives of the Association are to promote and increase the quality and quantity of rice produced in West Africa; to encourage production and use of varieties suited to the conditions of the member countries and to existing and prospective demand; to explore, introduce, and contribute to the extension of rational production methods adapted to the conditions prevailing in the region; to promote and implement measures for effective phytosanitary controls in relation to rice; and promote storage and processing, as well as marketing of rice both within countries in West Africa and with respect to external trade in rice.

The Headquarters of WARDA is located in Monrovia, Liberia. Overall control is vested in the Executive Secretariat.

There is a Research Department whose functions include the establishment of coordinated agronomic, varietal, plant introduction and protection trials; phytosanitary services; integrated special research projects for dryland irrigated rice (Richard-Toll, Senegal), mangrove rice (Rokupr, Sierra Leone), deep flooded and floating rice (Mopti, Mali) and rainfed rice (Bouake, Ivory Coast); reinforcement of the existing network of research stations in member countries in order to fill gaps in their research efforts; arranging conferences, seminars and workshops on topic relating to research; sponsorship of

certain low as well as high level training; and overall coordination of regional research from the headquarters as well as a network of sub-regional coordination offices.

There is also a Development Department whose functions cover mainly the economic and sociological aspects of rice production; outreach programmes in agricultural engineering, storage and processing, agronomy and extension, seed multiplication etc., and participation in the planning and execution of major national rice projects. It also arranges conferences, seminars, workshops as well as training on topics relating to development.

WARDA has a Training Department and Centre which provides middle level and specialised training for personnel from member countries. It also arranges for higher training (beyond the means of the centre).

Other supporting divisions include an Administration Division, A Finance and Accounts Division, a Personnel Division, a Documentation Division and a Communications Division. The Communications Division provides translation services, a rather crucial function in a bilingual organization such as WARDA. It arranges or provides interpretation services at conferences, seminar and workshops of the Association. It edits and publishes documents; is responsible for the Association's language laboratory and for the maintenance of good public relations. The Documentation Division has collected, processed and disseminated rice information to member states while maintaining a library for the immediate use of WARDA staff and providing member states access to rice literature through microfiches.

This report covers the activities of the Research Department of WARDA in 1978. Details are not included. Persons interested in the details are invited to contact the appropriate scientist or scientists involved directly or through the Executive Secretary of WARDA.

Although much has been achieved in the few years of existence of the Association, nevertheless, much needs to be done. We realise the need to redouble our efforts and resources in the ultimate goal of assisting the member states to reach self sufficiency in rice production and improve the economic and social well-being of the vast number of small farmers in the West African region.

We wish to thank all our numerous donors for their support without which next to nothing would have been achieved.

Sidi Coulibaly
Executive Secretary

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PROGRESS OF WARDA RESEARCH PROGRAMME

In 1972, 14 research projects were proposed by the Executive Secretary for consideration and approval. These were regrouped and later approved by the Governing Council on the understanding that the projects be integrated. Priority ratings approved by the Governing Council for the projects were:

1. Variety Improvement
2. Training
3. Coordination of Research and Development
4. Seed Multiplication
5. Fertilizer Trials
6. Agrometeorology
7. Weed Control
8. Plant Protection
9. Mechanization of Rice Cropping
10. Water Management

Studies of these projects by WARDA and Scientists from International Centres interested in rice led to the development of multi-disciplinary integrated research activities. Fig. 1 shows the present research structure of WARDA.

Projects on Agrometeorology, Water Management, Mechanization of rice cropping are still in the planning stage and will be implemented by the end of 1979 depending upon the availability of funds. The Water Management project is already being considered by some donor agencies for funding and the cost of evaluation team for the mechanization project is also being considered by one of our donor agencies. With the exception of the above mention projects, all the others have been implemented.

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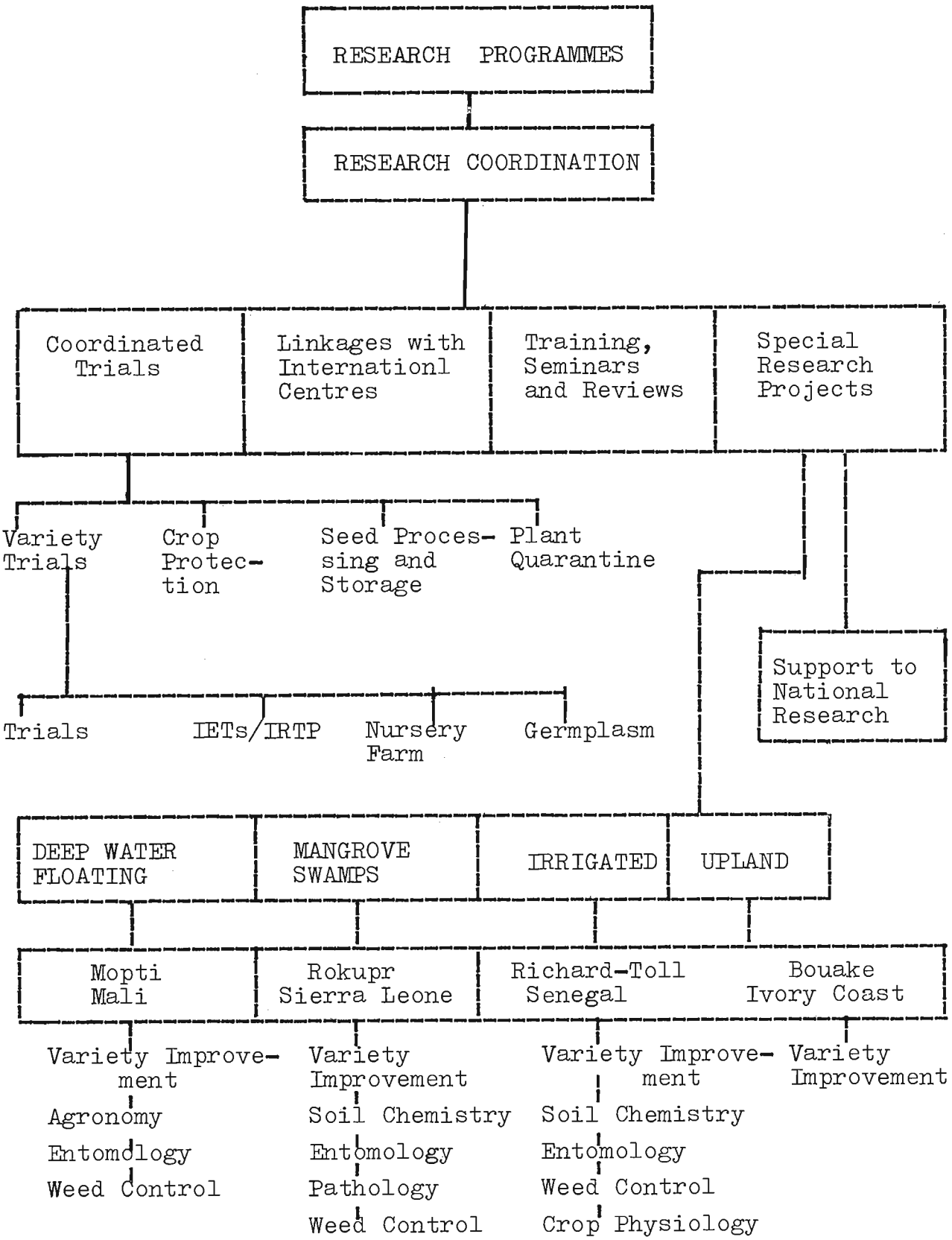
Fig. 1. WARDA RESEARCH STRUCTURE



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The research projects were later on classified as follows:

W1 - Coordinated Trials;
W2 - Variety Improvement;
W3 - Soil Fertility and
W4 - Crop Protection.

The W1 is administered from Headquarters in Monrovia and W2-W4 became the special projects. The W2 to 4 series led to multi-disciplinary and integrated approach with variety improvement as the main focus.

Thus research progress since 1974 was due to:

i) strengthening the management capacity of the research team;
ii) integrating the special research projects with the coordinated trials;
iii) establishing multi-disciplinary research team at the special research projects;
iv) strengthening support to national research activities;
v) developing closer ties between WARDA research activities and activities at the international centres; and
vi) strengthening the initial evaluation and preliminary variety trials.

Significant progress has been made in all the priority areas identified.

Progress in priority areas

1. Staffing: The Research Team and Management: (Table 1, shows the growth of the WARDA research team from 1973 to date. At the senior research staff level, there has been about 5000% increase in 1979 over the 1973 figures. About 50% of the total staffing is contributed by the Research Coordination funded by the CGIAR.

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The table reflects:

- the steady encouragement given in the over all management of the research programme through increased staff growth for the W1 project.
- the great progress made in introducing technical professional support to the coordinating programme.

Except for Rokupr, the situation with the Special Research Projects has remained unsatisfactory.

- for nearly three years now, it has been impossible to appoint the leader for the Mopti project and thus both the development of the project as well as research programme continue to be badly affected. However one Senior Scientist has been appointed.
- the Bouake projects has depended more on the activities of IRAT rather than of WARDA, in this respect, both the future involvement of WARDA in the Bouake project and the future of research on upland rice in West Africa had already been reviewed with the view of strengthening the project at Bouake. A detailed Project proposal has already been prepared for consideration by an appropriate donor and implementation next year.

For the special research projects, the success of future programmes and improved managerial capacities of the research teams would require additional staffing. The structures and the relevance of each special research activity needs examination, in order to ensure high quality of future scientific work. WARDA has requested CG to fund the position of the team leaders of the 4 Special Project Centres. The activities of each Special Project are reviewed annually in the inhouse review.

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Table 1:

STAFFING THE COORDINATED RESEARCH PROGRAMMES

	1973	1974	1975	1976	1977	1978	1979
Senior Research Staff	2	3	4	5	9	10	11
Assistant Research Staff	-	1	1	1	2	6	7
Senior Supporting Staff	-	-	-	-	-	5	5
STAFFING THE ROKUPR RESEARCH PROJECT							
Senior Research Staff	1	1	-	3	3	3	3
Assistant Research Staff	-	-	4	5	5	5	5
STAFFING THE RICHARD-TOLL/FANAYE RESEARCH PROJECTS							
Senior Research Staff	-	-	-	-	1	1	1
Assistant Research Staff	-	-	4	4	3	3	5
STAFFING THE MOPTI RESEARCH PROJECT							
Senior Research Staff	-	-	-	-	-	-	1
Assistant Research Staff	-	-	4	4	5	5	6
Senior Supporting Staff	-	-	-	-	1	1	1
STAFFING THE BOUAKE RESEARCH PROJECT							
Senior Research Staff	-	-	-	-	-	-	-
Assistant Research Staff	-	1	1	1	2	2	2
STAFFING THE WHOLE WARDA RESEARCH PROGRAMME							
Senior Research Staff	3	4	4	8	12	14	16
Assistant Research Staff	-	2	14	15	17	21	25
Senior Supporting Staff	-	-	-	-	1	6	6
TOTAL	3	6	18	23	30	41	47

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2. Integration: Structually, the WARDA research programme is now fully integrated. The main components are as follows:

i) the Research Coordinator has overall responsibility for the various aspects of the programme and is directly responsible to the Exectuve Secretary;

ii) team leaders are appointed to manage the Special Research Projects - these are directly answerable to the Assistant Research Coordinator who is responsible to the Research Coordinator;

iii) Sub-Regional Coordinators are directly in-charge of field activities at the national levels; they are directly responsible to the Research Coordinator;

iv) active linkages with international institutions and national institutions are maintained directly by the Research Coordinator;

v) linkage between the Special Research Projects and national research in fields related to the activities of the Special Research Projects are fostered by the team leaders cooperatively with national projects;

vi) working relationships among the Special Research Projects are maintained by direct contact among subject matter specialists in each field and exchange of visits;

vii) through the harmonisation of the special research activities with national research of host countries and cooperation with national institutions in the transfer of technology acquired;

viii) through WARDA seminars, workshops, regular visits of WARDA staff to national projects and participation in national research meetings; and

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ix) through meetings of the WARDA statuotory bodies i.e. Scientific and Technical Committee and Governing Council Meetings.

Functionally, there are still a number of weak links in the integration of activities. As mentioned previously, this is most serious in areas where leadership is either poor or lacking. Active integration is also a factor of time and staff quality. Full integration in terms of the coordinated trials and the special research projects will only come about when the Special Research Projects can put out high quality results that can strongly support the Coordinated Trials and the on-farm trials.

3. Multi-disciplinary Research Teams: The subject areas now covered (Fig. 1, Table 2) by each centre are by no means exhaustive. Further, leadership and staff quality are important components of multi-disciplinary research. It is our view that in these respects, WARDA still has a long way to go. High quality team build-up is also adversely affected by local facilities such as accommodation, medical and education facilities in addition to good facilities for high quality scientific work.

4. Support to National Research: This is a subject that has, over the past 5 years or so, seriously occupied the minds of all those who are connected with the need to accelerate food production especially in the developing countries and the relative roles which international, regional and national research activities can play towards this goal. In view of the complexity and the magnitude of this problem, we have tried to take a cautious approach to its solution. We have given support to national research programmes by the supply of minimal equipment to the total cost of $322,000 over the period 1975-1978, and in staff training particularly in support of the coordinated trials.

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We have tried to evaluate the level of rice research activities in each WARDA member state so as to allow us in some measure, to plan the level of assistance that is needed by each Government. Our over-riding concern at this stage is the level of support as translated into real rice production.

In strengthening national research activities towards the above goal, WARDA has been duly concerned about developing a philosophy for assistance. This involves Member Governments; Donor Agencies; Cooperating Organizations and International Institutions and the capacity of WARDA. Initial guidelines to such a philosophy and particularly WARDA's linkages with the International Research System are presented in Table 2.

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Table 2:

STAFFING THE COORDINATED RESEARCH PROGRAMME

Research Coordination
- Res. Coordinator
- Agronomic Statistician

Special Res. Projects
- Asst. Res. Coordinator

Supporting Technical Services
- Breeder
- Pathologist
- Seed Supt.
- Asst. Seed Supdt.
- Entomologist
- Asst. Breeder
- Asst. Pathologist

Sub-Regionalization
- 5 Sub-Reg. Coordinator
- 5 Asst. Sub. Reg. Coord.

Administrative Support:
- Financial Controller
- Architect
- Photographer (Vacant)
- Scientific Editor (Vacant)
- Translator

STAFFING THE ROKUPR PROJECT

- Soil Scientist (Team Leader)
- Entomologist
- Breeder
- Asst. Soil Scientist
- " Entomologist
- " Breeder
- " Pathologist
- " Weed Scientist

STAFFING THE BOUAKE PROJECT

- Assistant Breeder
- Assistant Agronomic Statistician (Vacant)

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Table 2: Contd.

STAFFING THE RICHARD-TOLL/FANAYE	STAFFING THE MOPTI PROJECT
- Soil Scientist (Team Leader)	- Director (Vacant)
- Asst. Soil Scientist	- Deputy Director
- Asst. Breeder/Physiologist	- Assistant Breeder
- Asst. Entomologist	- Assistant Agronomist
- Asst. Weed Scientist	- Asst. Entomologist
- Associate Expert (Breeding)	- Asst. Weed Scientist
	- Asst. Extension Officer

WARDA Research Network:- WARDA is playing a leading role in the Rice Improvement of the member states. The following are the most important elements of these inter-relationships:

(a) WARDA headquarters is the coordinating centre for regional research activities;

(b) its field research activities which constitute coordinated and on-farm trials of various types under varying ecologies receive technical or backstopping support in the following ways:

i) through the four regional research programmes each specialising on one form of rice cultivation (mangrove, rainfed, irrigated, floating), the activities at these centres are also coordinated and the results of their research which are essentially adopted from the international centres are fed into the regional coordinated trials; these programmes are developed and reviewed yearly with the participation of the international centres and national scientists.

ii) through a technical service division located at headquarters; it has laboratory facilities for seed services and a nursery farm for large-scale introduction of materials from abroad; for screening activities; for monitoring pest and disease incidence in West Africa; nomination of varieties in consultation with national scientists and distributing them for testing at various locations;

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iii) through active linkage with international and national institutes having strong programmes on rice i.e. IRRI, IRAT, IITA, BRRI, ICAR etc. there is a constant two-way contact between WARDA Headquarters and those institutes on all aspects of rice work - i.e. research, training, germ plasm collection and exchange, seminars and conferences, exchange of research results and other publications etc.

iv) through secondary contact between the WARDA regional research centres and the technical services division and the international centres.

The procedure established so far to extend these linkages to the national centres and enable them to successfully participate in the regional trials, to readily provide the necessary feedback to the international centres through WARDA and to strengthen their research activities, generally, is as follows:

i) member states have been regrouped into five sub-groups each sub-group comprising of 2-4 countries; a sub-group constitutes of sub-regiomal zone which is being managed by a senior agronomist and an assistant plus secretariat services: they also contribute to the rice research activities in the countries in which they are located;

ii) the regional coordinators are directly responsible for developing research services at national levels; these activities are backstopped by the four regional research projects and are coordinated by headquarters;

iii) WARDA headquarters still maintains direct contact with member states in spite of the sub-regional centres - this is generally in organizing workshops

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and seminars; review meetings; training programmes; supply of experimental equipment and maintaining the active interest of member states in these activities.

These inter-relationships are being made use of to strengthen national research activities through (a) developing research activities programmes, infrastructure and the training of personnel for the regional research projects associated with the respective national programmes; (b) funding the coordinated trials, training the field assistants assisting with the trials and ensuring that these trials are run directly by the national research or extension services with only supervision from WARDA staff; (c) providing equipment, minimum infrastructure and developing experimental land on national research stations which conduct the screening nurseries and the training of research assistants for appointment at national levels; (d) general training at various levels - rice production specialists; training at specialised levels - e.g. water management, seed multiplication.

Constant analyses of the national programmes gives an indication of the status of research in each member country. The figure shows the percentage situation in each case and was derived from existing research infrastructure, local research personnel and current research programmes.

These research programmes have been reviewed now and attempts made to bridge gaps where they are most acute.

Reciprocal Responsibilities:

The effective implementation of these inter-relationships will largely depend on the International Centres as well as the Regional/National Centres discharging certain responsibilities.

- requirements of the international centres:

  (a) strong inter-disciplinary research;

  (b) adaptation of results through regional programmes;

  (c) support to regional programmes through:
    i) staff training;
    ii) developing research programmes;
    iii) backstoping research activities through consultation, reviews etc;
    iv) international seminars; and
    v) supply of research materials and information.

- requirements of the regional/national centres -

  (a) maintain active communication with the international centres;

  (b) establish jointly, strong feed-back mechanisms;

  (c) provide facilities for short-term research workers from the international centres; and

  (d) supply of local germplasm and other materials for scientific research at the international centres.

Finally, this system of linkages has the following main advantages:

i) it makes research less expensive at all institutional levels;

ii) it tends to clearly show the role of the international centres as against the regional and national programmes both in terms of division of labour and the type of research that is required - this prevents unnecessary duplication and rivalry;

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iii) grouping countries with similar background enables them to work together at technical, social and political levels for mutual benefits;

iv) it has greater propensity in mobilizing local resources;

v) the use of localised organisations generates political goodwill and enthusiasm among local scientists; compared with the direct management by foreign institutions, this system would tend to be more permanent;

vi) it establishes definite lines of communication and exchange of materials and information at all levels; similarly, it facilitates international allocation of funds for research; and

vii) simple, adapted trials conducted in several places under one coordinating regional unit produce quicker, more reliable results that could have a direct impact on rice production.

The primary goal of this effort is to generate at national levels a genuine need and consciousness of utilizing available research information effectively, at minimum cost; to motivate national research approach to a West African Technology.

Strengthening the Initial Evaluation Tests:- The screening of a wide range of germplasm under the various agro-climatic conditions of the region since 1974 when its importance was recognized, has progressed considerably. The following significant steps have been taken in this regard:

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i) the establishment of 5 ha nursery farm at Suakoko, Liberia with full irrigation facilities; a laboratory; about 3000 lines are grown annually for preliminary observation and seed multiplication: (WARDA had to depend heavily in the early years on services provided by IITA and IRAT, Bouake as well as certain national stations);

ii) improving the seed service facilities at the seed storage centre;

iii) identifying 14 national stations within all the representative agro-ecological conditions for variety screening or "hot spot" testing; improving the research facilities at such stations and training national scientists who should participate in the screening;

iv) a Senior Breeder is in-charge of the variety introduction and field screening; and two Pathologists have been appointed to standardize the seed quality and quaratine aspects among other responsibilities; and

v) the construction of medium term seed storage facilities;

vi) Assistant Plant Breeder to be based at Suakoko will soon be appointed, to assist in the screening work at the station.

Progress was initially hampered by the lack of wide range of germplasm in large enough quantities for distribution; lack of adequate facilities and trained staff in several centres to embark on the tests and the lack of organising staff at WARDA Headquarters.

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Table 3:

PROGRESS IN THE IET PROGRAMME

Year	No. of Locations	No. of Entries	No. of Selections
1974	6	15	8
1975	6	62 (30 IITA, 32 IRAT)	23
1976	7	76 (52 IITA, 24 WARDA)	33
1977	11	400 (250 IRON-IRRI, 150 WARDA)	For this year only promising varieties for each location were identified).
1978	13	(136 UPLAND, 180 IRRIGATED)	First time to be seperated into Upland and Irrigated

Other drawbacks to fill implementation are administrative bottlenecks at national levels in developing the necessary facilities. Thus the target set for the number of sites has not been reached (Table 3).

The services of the WARDA special research centres will play increasing roles in the preliminary screening and the production of breeders seeds as these programmes develop.

The IET programme has not only made it possible for a wider range of germplasm to be introduced into the Coordinated trials but has encouraged national scientists to select certain outstanding varieties before they actually enter the regional coordinated variety trials.

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Funding: Funds for the research activities have come from two main sources (Table 4 and 5). The Consultative Group on International Agricultural Research (CGIAR) finances the overall research coordination which includes the supporting of the technical and administrative services at headquarters as well as the sub-regional programmes (Table 2). The special research projects are financed by bilateral fundings.

Table 4: CGIAR FUNDING OF THE RESEARCH COORDINATION ACTIVITIES ($1000 US $)

	1974	1975	1976	1977	1978	1979	Proposed 1980
Research Coordination including Training				688.3	355.0	-	-
Technical Services				-	236.3	-	-
Sub-Regional Coordination				599.0	801.7	-	-
Administrative Support				-	233.8	-	-
TOTAL	475.0	550.0	827.3	1287.3	1626.8	1927.0	2575.0

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2. Upland Condition, Short Duration Trial:

This was composed of entries adaptable under Upland Condition and having a maturity range of 95-110 days.

3. Upland Condition, Medium Duration Trials:

This was composed of upland entries of 111-125 days maturity.

4. Irrigated Condition, Short Duration Trial:

Varieties adapted to irrigated condition having a maturity range of 110-125 days were included in these trials.

5. Irrigated Condition, Medium duration Trial:

This was composed of entries adapted to irrigated condition having 126-140 days maturity.

6. Mangrove Swamp/Deep-Flooded Condition, Medium Duration:

This trial included medium duration (126-140 days) entries adopted to either Mangrove Swamp or Deep-Flooded conditions or both. However, no variety adapted to both the conditions could be identified.

7. Mangrove Swamp/Deep-Flooded Condition, Long Duration:

This trial included entries having life-cycle of over 140 days adapted to either Mangrove Swamp or Deep-Flooded condition or both. No commonly adaptable variety was identified.

8. Floating Condition, Long Duration:

Deep Water varieties (essentially long duration) tolerant to prolonged initial drought, sharp water rise and adapted to short flooding period were included in this trial.

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b) Present Set up of Coordinated Variety Trials

By 1977, it was realized that the general purpose - IET and Mangrove Swamp/Deep-Flooded medium and Long duration trials needed immediate reorganization to make them appropriate to the ecological conditions. From 1978, two different IETs were introduced; one for upland condition and one for irrigated conditions. Mangrove Swamp/Deep-Flooded trial were reorganized to make one trial for Mangrove Swamp condition and one for Deep-Flooded conditions from 1978. From 1979, another IET for deep-flooded condition is being introduced. All other coordinated trials will continue in 1979.

c) Future set up of Coordinated Trials

With the reorganization of some of the present trials, the following set of WARDA Coordinated Variety Trials (including IETs) is recommended:

IET:
1. IET for Upland condition - 15 sites
2. IET for Irrigated condition - 19 sites
3. IET for Deep-Flooded condition - 5 sites

Coordinated Variety Trials:

1. Upland trials for Savannah Zone:
   - short duration - 7 sites
2. Upland trials for moist-zone:
   - short duration
   - medium duration

   } 16 sites each
3. Irrigated trial for Sahelian zone:
   - short duration
   - Medium duration

   } 8 sites each in the main and dry seasons.
4. Irrigated trial for moist-zone:
   - short duration
   - medium duration

   } 21 sites each in the main and dry seasons.

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5. Cold Tolerance trial (Irrigated):
   - short and medium entries - sites

6. Salt Tolerance trial (Irrigated):
   - short and medium entries - 4 sites

7. Mangrove Swamp Trial:
   - medium and long entries - 7 sites

8. Deep-Flooded Condition Trials:
   - medium and long duration entries 7 sites

9. Deep Water (Floating) condition trial:
   - long duration entries - 5 sites

There will be a total number of 3 IETs and 12 sets of variety trials. The total number of experiments will be 166 in the main season, that is 16 more than the earlier agreed number of 150 due to this reorganization. In the dry season, maximum of 58 experiments will be done. This however, included Guinea. If any new country joins WARDA, the number will however, increase at the rate of 15 trials per country.

Due to related implications in selecting and nominating varieties for different trials mentioned above, implementation of this reorganization will have to be phased out. The following phasing is suggested:

IET

A: IET for Upland condition - implemented
B: IET for Irrigated condition - implemented
C: IET for Deep-Flooded condition - implemented

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Variety Trials:

1. Upland-Savannah-short duration - 1980
2. Upland-Moist zone-short duration - 1980
3. Upland-Moist zone-medium duration - 1981
4. Irrigated-Sahelian zone - short duration - 1981
5. Irrigated-Sahelian zone-medium duration - 1981
6. Irrigated-Moist zone-short duration - 1981
7. Irrigated-Moist zone-medium duration - 1981
8. Cold Tolerance (Irrigated) - 1980-81
9. Salt tolerance (Irrigated) - 1981
10. Mangrove swamp - implemented
11. Deep Flooded - implemented
12. Deep Water (Floating) - implemented

Infrastructural Development

Considerable progress has been made at each of the Special Research Project Centre with regard to infrastructural development.

At Rokupr the project is funded by USAID, Sierra Leone Government and WARDA; at Mopti by USAID, Malian Government, Saudi Arabia and WARDA, and at Richard-Toll by CIDA, Senegalese Government and WARDA.

Under the CGIAR funded programme the following facilities have been developed:

a) Seed Storage and Processing Laboratory at Johnsonville near Monrovia;

b) Laboratory and Offices for variety screening and seed production at Suakoko, Liberia, 5 ha of fully irrigated land at Suakoko for variety screening and seed multiplication;

c) A variety improvement laboratory and Cold-room for seed storage at Farakoba, Upper Volta.

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d) Three Glasshouses for Quarantine services at Ibadan, Nigeria and

e) Staff houses, office and laboratory facilities for the Sub-regional Coordinator located in the Gambia.

Under construction or nearly completed are field laboratories and equipment for varietal selection work at Haoueda, Benin; Niamey, Niger; Mission Tove, Togo, Contuboel, Guinea Bissau; and Kaedi, Mauritania.

Under the Plant Quarantine Programme a forth Greenhouse is to be constructed this year at Ibadan, Nigeria.

Herbicides and Insecticides Trials

Future work in this area will concentrate on the testing of the promising herbicides on farmers field. The details of such trials will be worked out after discussion between WARDA Scientists and the Scientists of the member countries.

The screening of newer herbicides and supporting research on their efficiency, selectivity and toxicity problems will be undertaken by the WARDA Special Research Projects.

The future pest control strategy is being reoriented on the following lines:

1. Monitoring the insect pest status in various rice ecologies:

   This activity has already been started and will continue from time to time to enable WARDA to maintain an inventory of changes in pest complex, in relation to on-going and future rice intensification programmes in the region.

2. Pest identification: This area needs strengthening at one or two locations in the region, to the extent that all destructive insect pests of rice should be readily identified by the workers.

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3. Biological control of major pests:

Collection, identification, conservation and dissemination of promising bio-control agents prevalent in the region and introduction from outside. This will require training of the entomologists working in or associated with WARDA. This would be a high priority activity.

4. Studies in ecology, population dynamics and seasonal fluctuation of major pests:

Some studies have been started in the Special Research Projects at Rokupr. Other research projects will also have to undertake work on similar lines.

5. Pest control through insect growth regulators attractants, repellents, etc:

WARDA is negotiating a collaborative research project with ICIPE, Nairobi in this direction.

6. Host resistance: This is a part of the varietal improvement programme and is being intensified.

7. Medium and Long-term pest forescasting:

Most pest and disease epidemics are created by faulty approach and hasty decisions on tempting yield strategies without realising the hidden dangers of pest upsurgences. These are not difficult to correct if breeders, agronomists and pest control scientists cooperate.

8. Pest management concept: The recommendation for a Seminar on Rice Insect Pest and Disease Management planned by WARDA in 1979, will form the basis of the future programme of this indispensable approach to pest control in the region.

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It may be emphasized that WARDA's research activities lack the minimum institutional support to undertake the programme outlined above. Nevertheless, as funds become available, the 4 Special Research Projects, will be suitably strengthened in the essential areas.

Special Research Projects: Despite certain handicaps like lack of electricity, Water, laboratory equipments, Senior Scientists and inadequate funding, Research projects at these centres are progressing slowly but steadily and in the near future when all those inadequacies are removed these centres will be able to play their role which in the development of technical packages that may lead through proper extension by National Officer to increased production of rice in the region.

The special research projects are funded bilaterally and currently the donors include Abu Dhabi, Belgium, CIDA, France, IDRC, Kuwait, Saudi Arabia, USAID, and the United Kingdom. Total funding has grown from about $360,000 in 1973 to a maximum of about $1.4m in 1976. The period 1975-77 were mainly investment years when construction of laboratories, houses etc. were funded. The diversity of funding of these projects reflects the difficulty in managing them.

2. Training: Table 6 shows the types of training that have so far been offered to WARDA research staff. Training for the special research projects which was financed by USAID was initiated in order to start the projects. It involved language course (Richard-Toll and Mopti) and a six month rice production course followed by six months of on-the-job training in the field of speciality of the candidate for all projects.

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These courses have been conducted in the USA (language) BRRI, IRRI and IITA, for technical training. The final phase of this type of training which has already started is for higher degree in the appropriate fields.

Specialised training of headquarters staff has involved staff at the WARDA Seed Laboratory - one of whom the Seed Technologist has completed a Master's course in Seed Technology.

Staff language training towards a working knowledge of either English or French is an essential part of integrated research activities and efficiency of management. While it has not been possible as yet to implement this on a routine basis, this should be encouraged in the future.

Training of staff from member states (Table 7) has been more or less confined to the Field Assistant training funded by the CGIAR originally in support of the coordinated trials but now covers field assistants also starting on other national rice projects.
The Genetic Evaluation and Utilization (GEU) training organized by IRRI is meant to train workers in the methodology of screening rice varieties. Since demand by Asian countries for this course at IRRI is very high and only limited place can be given to WARDA nominated participants, WARDA plans to initiate a similar course within the region. Specialised training of national scientists is as described for WARDA scientists but has so far been limited and has been funded by WARDA for courses at IRRI and IITA. France sponsored 3 national candidates in 1976 for higher level training in France Institutions. A Gambian is also undergoing higher degree training in Philippines at WARDA expense.

Table 6: WARDA RESEARCH STAFF TRAINING (m/m)

Research Coordination Training (m/m)

	1974	1975	1976	1977	1978	1979	Total (m/m)
- Language	-	1	3	5	5	1	13
- Production	-	-	-	-	-	-	-
- Specialised	-	6	-	5	18	1	30
- Field Assistants	-	-	-	-	-	-	-
							45

Rokupr Research Project Training (m/m)

- Language	-	-	-	-	3	1	4
- Production	-	-	24	6	-	-	30
- Specialised	-	-	-	24	6	2	32
- Field Assistants	-	-	-	-	4-5	2	6.5
							12.5

Richard-Toll/Fanaye Research Project Training (m/m)

- Language	-	16	-	-	-	1	17
- Production	-	24	-	-	-	-	24
- Specialised	-	-	24	-	-	1	25
- Field Assistants	-	-	-	3	3	2	8
							74

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Table 6 (cont'd)

WARDA RESEARCH STAFF TRAINING (m/m)
Mopti Research Project Training (m/m)

	1974	1975	1976	1977	1978	1979	Total (m/m)
- Language	-	16	-	8	-	1	25
- Production	-	24	-	6	-	-	30
- Specialised	-	-	24	6	-	2	32
- Field Assistants	-	-	-	-	-	-	-
							86

Table 7:

Research Staff Training Through Research Department for 6 Member States(m/m)

	1973	1974	1975	1976	1977	1978
- Language	-	-	-	-	8	-
- Production	-	-	-	-	18	-
- Specialised	-	-	-	9	54	15
- Field Assistant	55(USAID)	-	18	36	45	49.5
- G. E. U.	-	-	-	-	8	12

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Transfer of Technology

In the area of transfer of technology the following elements are important:

1. The development, through plant improvement programme, high yielding varieties of rice with wider adaptability. Table 8 shows several rice varieties which have gone through the WARDA coordinated trial programme and are now either being grown or at the seed multiplication stage in certain member states. Few of these varieties might have been introduced into these countries before the WARDA variety testing started.

The table clearly indicates the impact of the WARDA variety improvement programme on rice cultivation in certain member states.

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Table 8:

High yielding rice varieties of West Africa Region identified through WARDA Trials

	Upland	Irrigated	Mangrove	Floating
Benin	IR442 (Hydromorphic)	IR8, IR442, IR20, IR22 68-83		
Cote d'Ivoire		IR5, Jaya		
Gambia	I Kong Pao SE 302 G	IR28, IR20 IR 22	ROK 5 Phar Com En SR 26 B	
Ghana	IR20, IR442	IR442, IR20 IR5, CICA 4 IR1833-208-1-3		
Guinea Bissau	SE302G I Kong Pao IRAT 10	IR20, IR23 IR5, IR442	ROK 5	
Haute Volta	IRAT 10 SE302G Dourado Precoce	IR1529-680-3 IR20		
Liberia		IR5		
Mali	ROK 2 IR442 (Swamp) ROK 5 (Swamp) IRAT 10	D52-37 Sigadis		
Mauritania		TNI		
Niger		D52-38, IR22, IR 8		
Nigeria		IR269-26-3-3-3		
Senegal		IR 8		
Sierra Leone	LAC 23			
Togo	IR 8, IR442 D52-37			

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PROPOSED NEW ACTIVITIES AND CHANGES IN ON-GOING ACTIVITIES

1. Research on Upland Rice for the Moist-Forest zone of WARDA

The progress on upland rice research in the "Moist-Forest" zone of WARDA region is below expectation for various reasons. The proposed expansion of WARDA Special Research Project for upland rice at Bouake (expected to be started in 1979) is likely to achieve rapid success for the "Savannah-Forest" zone.

2. Hybridization Programme for Moist Forest Zone

The moist zone will be little benefited from the above project because of differences in environment, ecology, disease, etc., which cause major differences in varietal adaptability and production technology. Varieties for the moist zone must be bred and developed within this ecology for rapid and dependable results. Research on upland rice for moist-zone can be carried out by the core of scientists based at the Headquarter.

3. Development of technical packages under the Special Research Projects

These packages have to be tried under farmers conditions, if the response for such packages under experimental conditions show increases in yield of the order of 50-100% before being recommended to the farmers.

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The Rokupr project has conducted trials on farmers fields in Sierra Leone and the use of two wheeled tractors in Mangrove Swamp cultivation has proved very successful in suppressing weed growth and thereby leading to increase in yield. At Mopti the extension officer is working closely with farmers to better cultural practices and encourage the use of improved varieties and practices.

In Richard-Toll/Fanaye work on the response of N fertilizer using high yielding variety from IRRI (IR8) have shown that a combination of proper spacing, variety and N application will be profitable. However, it is essential that these findings be confirmed under farmer's conditions. The Sub-regional programmes now include on-farm trials and for this year there will be 10 trials per country.

4. Training: For proper supervision and implementation of coordinated and on-farm trials it is essential that National junior scientists be trained to manage such programme so as to ensure that reliable results are obtained. This will ensure the success of the on-farm trials which is an essential step before any package is introduced to the farmers through the national programme. The Research Department funds the training of Research Assistant/ Field Assistants for this purpose.

5. Identification of the Constraints

For the package of technical inputs to be developed it is essential that the constraints to high yield be identified. For this each of the Special Research Project will have a production economist/extension officer.

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The officer will identify the constraints under farmers conditions and with the help of the Research Scientists at the Special Project Centres develop appropriate packages to remove the constraints. These packages will first be tried under experimental field conditions, followed by trials under on-farm trial programme. Any package giving encouraging results will be passed on to the National Programme for extension to the farmers.

6. Germ plasm collection and evaluation will continue on a small scale and the construction of the medium term seed cold storage will take place in Monrovia. The IITA/WARDA Liason Officer is incharge of the germ plasm programme.

7. WARDA will participate in the IRTP especially for salt tolerance, cold tolerance, iron toxicity tolerance and tolerance to submergence. These trials will be conducted mainly at the Special Project stations and at Suakoko.

8. Three glass houses for Plant Quarantine services at Ibadan have been completed but an additional one will be constructed this year to cope up with the increased number of rice varieties being quarantined at this station.

9. An expansion in the Seed Laboratory to make provision for a seed health testing unit is to be undertaken and two large germinators are to be added to the Seed Laboratory to ensure rapid and reliable testing of large number of varieties of rice seeds for their viability before being dispatched for the coordinated trials.

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10. On-Farm Trials - On-Farm Trials will be conducted during the main and off-season. There will be 10 trials per country bringing the number of trials to 150 in 1980.

11. The Seed Nursery Farm at Suakoko will continue to present activities, such as introduction, screening, selection and multiplication and some aspects of new elements namely, re-organized variety trials will be added to the programme.

12. The department is to initiate the publication of Research newsletter as from the middle of this year.

13. In collaboration with Catholic University of Louvain in Belgium and funding support from Belgium Government a research in the use of Azolla in improving soil fertility of rice fields is to be started. The projects will be located at Richard-Toll, Rokupr and Suakoko.

14. Project document on all aspects of rice mechanization will be drawn up after an evaluation team has visited member states and discussion held between the team and WARDA Scientists. The Director General of IRRI has given assurance of collaborating with WARDA on this project.

16. Strengthening of the Upland Research Project at Bouake is to be undertaken in view of the importance of upland rice in member states of WARDA. The strengthening will involve the appointment of about 9 scientists provision of two laboratories, staff houses etc. The Government of Ivory Coast has agreed to provide land for the expansion, 3-4 staff houses and one laboratory building.

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17. Strengthening of the other Special Project Centres are essential especially in the area of staffing. For this WARDA has requested CGIAR to fund the position of the four team leaders in the 1980 budget recently submitted to CG in Washington.

18. Project document on bird and rodent control is in the process of being prepared. The document will take into account the recommendation of the experts who took part in the Bird and Rodent Control Seminar in Monrovia, Liberia.

19. Collaborative work between ICIPE and WARDA on Stemborer damage evaluation control, selection of resistant varieties and mechanism for resistance is planned.

20. Project document on water management studies has been prepared and sent to some of our Donor for funding consideration.

21. WARDA will collaborate with the Sahelian Institute on rice based on farming system.

22. The programme on double cropping and ratooning is to be continued at Richard-Toll/Fanaye and the possibility of taking a short duration crop after rice is to be included in the research programme at Mopti.

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TECHNICAL SUPPORTING SERVICES

The Technical Supporting Services include the Seed Nursery Farm at Suakoko (Liberia), Seed Laboratory and Processing Centre at Fendall (Liberia), Plant Quarantine Centre at Ibadan (Nigeria) and West African Rice Germplasm Conservation.

At the moment, the activities of this Division fall into:

(a) Variety Introduction and Improvement;

(b) Seed Storage, Processing and Distribution;

(c) Plant Quarantine;

(d) Crop Protection Service;

(e) Germplasm Conservation and

(f) International Rice Testing Programme.

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The research programme includes:

(a) Introduction of varieties and breeding lines from IRRI, Bangladesh, India, Indonesia, Malaysia, Sri Lanka, Thailand, CIAT, IITA, IRAT and other national and international programmes including the West African region;

(b) Examination of each seed sample coming from outside West Africa at the Plant Quarantine Centre for "dangerous diseases";

(c) Screening of introduced materials at the Seed Nursery Farm for desirable plant type-height and architecture; disease and insect resistance; stress and problem soil tolerance, grain yield and general adaptability;

(d) Selection of promising lines for IET, coordinated variety trials, special research projects and national programmes;

(e) Seed increase of selected varieties;

(f) Maintenance of varieties under trial;

(g) Seed processing and testing;

(h) Seed treatment for trials;

(i) Seed packaging and despatch to trial points and other programmes;

(j) Monitoring of diseases and pests in the region;

(k) Rice germplasm collection, evaluation, preservation and utilization and the International Testing Programme;

(l) Training of scientists and technicians;

(m) Supervising WARDA IET programmes; and

(n) Professional support to the WARDA Special Research Projects.

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Seed Nursery Farm

The Seed Nursery Farm located at Suakoko in Liberia was started in 1976 with two hectares of irrigated land. The area was gradually increased to about five hectares - four hectares of lowland (irrigated) and one hectare of upland. These areas are considered adequate for the present activities.

One laboratory-cum-office building, one tool house and a threshing floor have been constructed. The laboratory has been equipped and a sample dryer has been installed. The farm has two power tillers and other farm tools. A new tractor has been procured for farm services. Irrigated water is supplied from a nearby dam throughout the year. Cropping is continuous on the farm.

At present, the farm is managed by a Senior Field Technician. An Assistant Rice Breeder has been identified and soon he will be located at Suakoko as the head of the farm. This will improve the quality of our work.

In addition to seed increase programme at Suakoko, selected varieties are multiplied at Richard-Toll (Senegal) under the supervision of Physiologist-Breeder for obtaining larger quantities of seeds from smaller plots, and for disease free seeds. Varieties which have chances of nomination in the trials and varieties which are retained in the trials are only multiplied at Richard-Toll. Seeds of nominated varieties are brought to Monrovia for treatment and distribution. Grain yields at Suakoko are always low due to environmental and disease constraints and seeds harvested during the rainy season are generally not clean due to hull diseases.

The number of new entries tested, seed increase - observation plots and varieties nominated for the IETs and coordinated trials from Seed Nursery Farm for 1979 are shown in Table 9.

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Table 9: Number of varieties tested, observation plots at Seed Nursery Farm and number of nominated varieties for trials of 1979

1.	Number of new lines tested	:	1608
2.	Number of seed increase cum observation plots:		
	(a) Suakoko	:	627
	(b) Richard-Toll	:	90
3.	Number of varieties nominated from SNF for IETs of 1979:		
	(a) Upland IET	:	183 (66,0%)
	(b) Lowland (Irrigated) IET	:	206 (99.0%)
	(c) Deep Flooded IET	:	42 (100%)
4.	Varieties nominated from SNF for Coordinated Variety Trials of 1979	:	25 (80.6%)

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Seed Lab and Processing Centre

The Centre continued to discharge its vital role in the WARDA Coordinated Variety Trials (CVT) and Initial Evaluation Tests (IET). The details of seed lots finalised from the CVTs/IETs are summarised in Table 10. Of the total of 626 entries, 101 constituted the 7 Variety Trials and the remainder were for the IETs. The IET - Deep Flooded was a new addition for 1979.

Apart from such essential operations as analysis for purity, processing of newly harvested material and germination tests, each variety was subjected to hot water treatment at 58 - 60°c for 20 minutes in fulfilment of the regional seed quarantine requirement. This was followed by drying of the seeds to a safe moisture level, post treatment germination studies and dusting of seeds with Aldrex-T (mixture of an insecticide and a fundgicide) for additional protection before final packaging.

A total of 482 new introductions were received from institutions outside the region and seeds of 45 varieties supplied to countries in Africa, Asia and Latin America (Table 11 and 12).

Seeds of 306 varieties were made available for the off season multiplication at Suakoko and of 120 varieties for the main season both at Suakoko and Richard-Toll.

Within the limited space of the Centre, steps have been taken to establish a Pathology Lab mainly with object of upgrading the seed quality through health testing and appropriate treatments. The Laboratory is also intended to undertake diagonosis of rice diseases in the region.

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A comparison of the germination counts of seeds of 101 entries in 7 CVTs before and after hot water treatment (including dusting with the pesticide mixture) confirmed the earlier observation that the treatments do not impair in any way the germinability of the seed harvested during the same year.

Table 10: Number of Varieties, Trial Sites and Seed Packages for each Coordinated Variety Trial and IET - 1979

Type of Trial	No. of Varieties	No. of Trials	Number of packages for each trial
1. Upland Short	14	19	266
2. Upland Medium	14	18	252
3. Irrigated Short	14	28	392
4. Irrigated Medium	14	30	420
5. Mangrove Swamp	14	6	84
6. Deep Flooded	15	6	90
7. Floating	16	4 + 1*	64
8. IET Upland	275	15	4,125
9. IET Lowland	208	19	3,952
10. IET Deep-flooded	42	5	210
Total	626	151	9,855

*Seeds for Mopti Centre already available with them.

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Table 11: Seeds received during May 1978 to April 1979

Source	No. of Varieties	Remarks
Suakoko (WARDA Nursery Farm) Liberia (Ferme semencière ADRAO)	1,633	
Richard-Toll Seed Multiplication Centre, Senegal (Centre Mult. semences Richard-Toll	159	
Bouake IRAT (Ivory Coast) (Bouaké IRAT (Côte d'Ivoire)	91	For Coordinated variety Trials/IETs.
WARDA Special Res. Project, Mopti, Mali (Projet Spécial Mopti)	16	
IITA, Nigeria	40	
College of Agriculture & Forestry, Liberia (Japanese varieties through a Japanese Expert)	68	New Introduction
Indonesia (via IRRI)	238	
IRRI (Mangrove swamp)	176	
	2,721	

Table 12: Seed Dispatched to Countries Outside WARDA Region May 1978 to April 1979

Countries	Number of Varieties
Zaire	5
Argentina (Argentina)	3
Japan (Japan)	27
Madagascar	10
	Total = 45

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WARDA Monitoring Tours

In 1977, the WARDA Secretariat was assigned by its Governing Council, the task of conducting study or monitoring tours to assess pest and disease incidence in its member states. The original proposal was made at the WARDA Fourth Research Review Meeting in May 1977, as follows:

"(1) an action programme in two stages based on the division of West Africa into a humid zone and a savannah zone;

(2) creation of a multidisciplinary team (pathologist, entomologist, soil scientist and physiologist) who would rapidly explore the member countries to collect information on diseases and insects. For this reason, WARDA contact national or international agricultural organizations in the regions to be explored, so as to make information available to the team.

(3) there should also be a more thorough long-term investigation into the disease situation of the countries in line with the intensity of the phenomenon.

For the exploration, the region should be divided into sub-regions, and WARDA should make use of the facilities offered by well-equipped national institutes of certain member countries. For the other countries, the Sub-committee recommended a team of specialists chosen in such a way that the area concerned could be covered. It would be up to WARDA to work out the subjects, details and methodology of the undertaking."

The mandate for the short-term activity was to collect information on diseases and insects. However, in view of the request to assemble multi-disciplinary teams for this purpose, the WARDA Secretariat enlarged the terms of reference of the missions to collect information on the following:

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- rice diseases and their intensity.
- insects and the extent of damage caused.
- varietal reactions.
- soil problems affecting rice growing.
- environmental problems.

The teams were also required to report on production constraints and make recommendations on removing these contraints.

The first phase of the assignment was started in 1977 and completed in 1978. Five teams of 3 to 4 experts constituted by WARDA visited 14 member countries in convenient groups. In each country one or more national scientists participated in the mission. The tours were concentrated during the main crop season between September and November. Guinea having become member of WARDA later was not covered.

The five reports have been finally edited and summarised into one document entitled "WARDA Monitoring Tour Reports".

The important contents of the document are:

1) An appraisal of the constraints limiting the Uniformity and depth of the observations by the teams.

2) Consolidated lists of diseases and insect pests reported by the teams countrywise.

3) Disease and pest distribution maps for each country indicating the locations visited by the teams. Intensity of the diseases/pests wherever recorded is also included.

4) Specific soil and climatic constraints such as mineral deficiencies and toxicities and drought and cold stresses.

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5) A few important weeds in some of the countries.

6) Observations the reaction to diseases, pests and environmental stresses of rice varieties observed by the teams at various sites. The rice ecologies of the crops observed are also indicated.

7) The recommendations made by the teams for each country which have direct bearing on increasing rice productivity.

Summary and Recommendations

The main object of these tours, namely an assessment or survey of the insect pest and disease situation in West Africa on a short-term basis, has been considerably achieved. Certain important insect pests and diseases which had hitherto been merely speculated to exist have been confirmed by the teams. For example, the WARDA region has ecologies which are quite favourable for the build up of brown plant hopper and green leaf hopper and the associated destructive virus diseases.

The bacterial blight and streak diseases have been found to occur at several places. The economic and biological significance of these findings are immense. We now have to undertake long-term planning and more methodical evaluation and reassessment of the situation so as to monitor the impending dangers to rice cultivation in West Africa, and to prepare preventive and economically sound control measures. Such programmes will need the full participation of the WARDA Special Research Projects and more importantly, of the national research institutions and other organisations in the region both for periodic monitoring tours and for routine surveys at national levels.

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Rice germ plasm collection

WARDA has the following objectives as far as rice germ plasm collection is concerned.

1. To extend logistic and/or administrative support to both IITA and IRAT when needed for germ plasm collection in WARDA region.
2. To evaluate in cooperation with IITA & IRAT African rice germ plasm collected.
3. To maintain collections in a medium-term storage facilities.
4. To assist IITA & IRAT on rejuvenation.
5. To encourage in the region the Utilization of the collected germ plasm.
6. To collect in certain key areas where IITA and IRAT-ORSTOM have never collected, not collected, recently, or not adequately collected.

Programme Execution

In pursuance of the above objectives, WARDA's methods of achieving them are described in the ensuing paragraphs.

1. Support for and collaboration with Institutes in the WARDA Region

WARDA staff have been authorized to give on request any possible assistance to the collecting teams from IITA, IRAT-ORSTOM etc., in the region. An example of such an assistance was the administrative support given to the ORSTOM/IRAT Mission to Guinea Bissau. WARDA was able to obtain permission from the Guinea Bissau Government to allow the IRAT-ORSTOM team to collect rice germplasm in Guinea Bissau from November to December 1978.

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In 1978 we have received different collections from IRAT-ORSTOM, IITA and other national programmes like the Central Agricultural Experiment Station at Suakoko, Liberia. These are kept in our Cold Storage at Fendal, Liberia.

These collections are made up of the following species: glaberrima, breviligulata, punetata, longistaminata, etc. In February 1978 we received from IIRA 283 accessions.

2. WARDA Special Project's Collections and Evaluations

Our Special research projects have initiated routine collection programmes in their area of influence. Although some of these collections could be classified as active or breeder's working collections. Some of them will enter the germ plasm accession after the current multiplication and evaluation. They will be sent to the headquarters for storage and distribution to IITA, IRAT and IRRI.

At our Mangrove Swamp rice project 350 accessions were evaluated in 1978. The staff of the Special Project in Richard-Toll collected 164 cultivars in the Cassamance, Senegal. Fifty-seven of these have been sent to the WARDA headquarters and the entire collection is currently being evaluated and multiplied at Fenaye-Senegal.

3. Appointment of a Rice Breeder for WARDA Germ plasm and other duties

In an attempt to move faster and coordinate activities on germ plasm collection, evaluation and utilization a Rice Breeder (on secondment from IITA) was appointed in September 1978. WARDA germ plasm programme is one of his main assignments.

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4. Visits to other National and International Programme on Germ plasm Collection Evaluation and Utilization

The WARDA staff in charge of this programme has visited IITA, IRAT, Bouake, IRRI, Richard-Toll, Rokupr and Mopti in connection with germ plasm activities. At some of these places materials being evaluated were observed on the field and in other places general discussions on various aspects of germ plasm took place.

5. Coordination of IITA and IRAT information

At the WARDA headquarters we intend to make available to all appropriate researchers information received from IIRA and IRAT-ORSTOM and other institutes in the region in a summarized form. Example are collections made by these two institutes in 1977.

a) IRAT-ORSTOM 1977 Germ plasm Collection in WARDA Region

In 1977 IRAT/ORSTOM collected different species in many African countries. The summary of the collection made in WARDA member countries only are shown in Table 12.

Interesting collections were also made in Chad and Cameroun Republics.

Table 12: IRAT/ORSTOM Germ plasm Collection in WARDA Region - 1977

Species:	Number collected/spp. in each country:		
	Ivory Coast:	Mali:	Senegal:
Oryza Sativa	394	1	1
O. glaberrima	15	-	3
O. breviligulata	-	26	20
O. longistaminata	-	7	7
Others	-	7	-
Total =	409	41	31

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b). IITA Germ plasm Collection in 1977

Germ plasm collections made by IITA's Genetic Resources Unit are summarized in Table 13. Prof. H.I. Oka from Japan Played the leading role in the collection made in Northern Nigeria.

Table 13: IITA Germ plasm collection in 1977

	Number collected per species in each country					
	NIGERIA:		LIBERIA:	S/LEONE:	MALI:	I/COAST
Species:	OKA in Nigeria	Steele in Benue/Plateau States				
O. sativa	21	125	170-1 wild rice	287	-	-
O. glaberrima	20	119	34	36	-	-
Mixtures sativa/glaberrima	3					
O. barthii	18			2		
O. longistaminata	23	10		1		
O. punctata	7					
O. tisseranti	2					
Spp. to be identified	12				12	17
Total	94	266	205	326	12	17

6. WARDA Special Collection in Key Areas:

In accordance with our 6th objective above, in 1979 WARDA with the help of one or two Consultants will carry out collection expeditions in some parts of Mali and possibly in Nigeria. Emphasis will be to collect the endangered species or types along the river Niger. Preliminary contacts and plans have been made for these.

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7. Evaluations:

Evaluations of germ plasm collections will continue and intensified in 1979 both at our special research projects and at Suakoko in Liberia.

8. Medium term cold storage:

The proposed medium term Cold Storage construction will start in 1979.

9. Utilization of germ plasm materials:

WARDA will attempt to characterise from time to time certain number of the accessions and recommend their use by rice scientists in crop improvement activities. Information received from other institutes will be widely circulated from WARDA.

International Rice Testing Programme (IRTP) in the WARDA Region

Introduction

WARDA recognizing the need to supplement the hybridization programmes of rice breeder and other scientists in the region, participates actively since 1977 in the IRTP which is coordinated from the International Rice Research Institute (IRRI).

WARDA's Roles in the IRTP

WARDA being a regional association has a major responsibility of coordinating IRTP nurseries. The objectives of WARDA's participation in the IRTP are as follows:

1. To ensure that the IRTP cultivars entering the region go through the regular plant quarantine clearance in the Regional Plant Quarantine Center in Ibadan, (Nigeria).

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2. To assist the National and WARDA special research programmes to receive appropriate nurseries with the minimum delay.

3. To make known to all scientists in the region the available IRTP nurseries.

4. To make staff available to go and inspect the nurseries in various countries.

5. To coordinate the various information on the nurseries e.g. nursery dispatches and when, time of planting and where, results to IRRI, nursery requests, and varietal nomination into different IRTP nurseries.

The use of IRTP materials in WARDA

Cultivars from the IRTP enter into WARDA coordinated trials and IETs through two major channels. The first is through nominating them from national and international research programmes. The second channel is through WARDA's staff who screen the materials in different places and suggest those to enter a given trial either at IET level or coordinated trial level. Through these processes most of the entries in WARDA coordinated trials are cultivars from IRTP, especially the irrigated trials. Examples are the entries in the lists of the 1979 WARDA short duration trials (Table 14). Beside the direct use of the IRTP cultivars many of the rice breeders in the region have used them as parents in their hybridization programmes.

Results of 1978 IRTP in West Africa:

Table 15 shows the 1978 IRTP nurseries received and where they were sent for planting in 1978 and 1979. Some of these have been planted while others would be planted in 1979.

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Among nurseries already planted are: IRON at Suakoko being screened by the National Rice Breeders in Liberia under Iron toxic and non toxic conditions, URON being multiplied at WARDA's nursery and IRCTN planted at three dates of planting and at three location by the WARDA staff at Richard-Toll, Senegal.

Table 14: The use of IRTP Cultivars in the 1979 WARDA Coordinated Short Duration Irrigated Trial

CULTIVARS	IRTP NURSERIES IN WHICH THEY OCCURED	ORIGIN
1. NTU770-7-2 (check)		India
2. BG90-2	1974 & 75 IRON, 1974 IRYN	Sri Lanka
3. ROK 12 ADNY 11	1975 IRBN	IRRI
4. IET 2775	1976 IRON	India
5. BP1-76^{9}xDawn	1976 IRON 1976 IURON 1976 IURYN	IRRI
6. BR51-46-5	1975 IRON, 1977 IRYN-M	Bangladesh
7. IET 1444	1974 & 1975 IRON and 1976 IURYN	India
8. MTU 8431	1977 IRYN-L	India
9. BW 1444	1975, 76 & 77 IRON	Sri Lanka
10. IET 1785	1976 IRYN-M	India
11. MRC 505	1977 IRON	Phillippines
12. IR2798-107-3	1975 IRON	IRRI
13. IR3273-P339-2	1977 IRON	IRRI
14. IR2042-178-1	1976 IURYN, 1976 IURON	IRRI

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Table 15: 1978 Inventory of IRTP Nurseries for WARDA Region

Type of Nursery	Date Received	Total No. of Sets	Total No. of Entries	Plant Quarantine, Ibadan			Dispatch Details		
				Date sent	Date cleared	Entries cleared (o)	Destination	No. of Sets	Date
IURON	Sent by IRRI directly to Dr. Aluko in Ibadan in May & June	8	171	N.A.	09-08-78	167 Nos. 7,50 & 87 not cleared	Ghana Gambia I/Coast Liberia Senegal Nigeria G.Bissau	1 1 1 1 1 2 1	10/1/79 14/1/79
IRON	"	2	389	"	09-08-78	All	Liberia	1	Nov. 1978
IRLRON	"	3	261	"	09-08-78	All	Ghana Liberia S.Leone	1 1 1	10/1/79 08/9/78 14/9/78
IRCTN	"	4	237	"	09-08-78	All	Mauritania Nigeria Senegal	1 1 2	08/11/78 08/9/78 14/9/78
IRDWON	"	4	28	"	20/12/78	All	Mali Niger Nigeria	1 1 2	May, 1979 " " Sent directly from IRRI
IRBN	"	4	527	"	20/12/78	All	Liberia S.Leone	1 1	 Feb., 1979
IRSATON (Salinity)	"	2		"	Not Received		Senegal S.Leone	1 1	

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This enables the determination of cold tolerance at seedling, maximum tillering and heading stages. From the assessment so far, 66 out of the 237 entries are tolerant at one or more growth stages at Richard-Toll (Senegal).

Nomination into the 1980 IRTP

In order to allow other scientists outside the region to know what type of materials we are developing, WARDA encouraged all those involved with varietal improvement to nominate few very promising lines into the IRTP nurseries. We shall assist in coordinating these. For instance WARDA staff hand carried the nominations in Table 16 to IRRI. Several nominations have also been received from IITA for 1979 IURON.

The Impact of the IRTP Cultivars in the WARDA Region

Apart from using the cultivars for hybridization and advanced trials in the region through effort of WARDA and several national and international programmes the impact could be assessed on the farmers fields. This is illustrated by the many cultivars which directly or indirectly emanated from IRTP that are currently being multiplied on a large scale for release as varieties in many places in West Africa. Some of these are shown in Table 17.

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Table 16: Some of the Cultivars Nominated into the 1979 IRTP Nurseries from WARDA Region Sierra Leone and Liberia

Cultivars	Pedigree(if known)	Type of Nursery	Nominating Station
LS(1)-31-2	A6-1037/LAC 5 IR5994-introduced at f_2 in 1975	IURON	Central Agric. Res. Station' Suakoko, Liberia.
LS(25)-4-1	IR2031-238-5-2-6/ AUS 14/IR2061-2132 f_2 in 1975	IURON	" "
TOX 95-B1-1-L53	63-83/Moroberekan introduced at F_5 from IITA	IURON	" "
Suakoko 8	Siam 29/Malinja 3 Introduced as 2526 (f) cross made at Bombonglima Malaysia	IRON	" "
ROK 8	C134.3	ISARTON	Rice Research Station, Rokupr Sierra Leone
ROK 9	C13f.1	"	" "
ROK 10	BC4-E	IRDWON	" "
ROK 15	Anethoda/BG7.3	IURON	" "
ROK 16	Ngovie	IURON	" "

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Table 17: Promising or Recommended Cultivars Emanating Mostly from IRTP Nurseries in West Africa

Cultivars	Countries of Importance	Some IRTP Nurseries in which they occurred
1. BG 90-2	Nigeria, Sierra Leone	1974 & 75 IRON and 1974 IRYN
2. BR 51-49-6	Ghana	1975 IRON
3. BR 51-319-9	Gambia	1975 IRON
4. IET 2885	Mali*	
5. IR269-26-3-3-3	Nigeria*(TOs 78) Mali* Niger	1973 IRYN
6. IR442-2-58	Benin*, Gambia*, Ghana*	1975 & 1976 IURON
	Guinea*, Bissau*, & Togo*	1976 & 1977 IURYN
7. IR578-95-1-3	Ghana, Nigeria	1973 IRYN, 1974 & 1975 IRON
8. IR1529-680-3	Benin, Gambia, Ghana Ivory Coast, Mali* Niger*, Togo & U/Volta*	1975 IRON & 1977/IRBN
9. IR1561-228-3	Mauritania	
10. JAYA	Ghana, Ivory Coast*,	1973 IRYN and
	Mali* and Senegal*	1975 IRON
11. MAHSURI	Sierra Leone	1975 & 77 IRON
12. VIJAYA	Upper Volta*	1974 IRON
13. ROK 11	Sierra Leone*	1975 IRBN
14. ROK 12	Sierra Leone	1975 IRBN

*Where recommended as Varieties or being multiplied on a large scale.

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THE WEST AFRICAN ENVIRONMENT

The diversity and the relative areas of the conditions under which rice is cultivated in West Africa is reflected in a "Rice Type Classification" adopted at the 1978 WARDA Annual Research Review Meeting, as shown in Table 18.

In designing the coordinated trials, one had to take into account the following important factors:

i) rainfall distribution pattern and evapo-transpiration;
ii) solar distribution and temperature pattern;
iii) soil types and types of culture;
iv) level of management; and
v) characteristics of varieties utilized; and incidence of pests and diseases.

The important climatic differences within the broad West African belt are due to simple mechanisms of the general circulation of the atmosphere over the area. The belt is fed by moisture-laden air from the Atlantic and dry harmattan winds from the North. While the southern winds have equitable temperature, the harmattan is cold during the northern winter and hot in the summer. The WARDA region can thus be broadly divided into:

i) area of short summer rains as found mainly in the north of the region often associated with long periods of hot/dry weather and cold seasons with long sunshine hours;
ii) area of two rainy seasons separated by a short dry spell and a longer dry season during the northern winter; and
iii) coastal areas of heavy and long periods of rainfall due to the effect of the sea and the coastal alignment.

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Generally, a minimum rainfall of 600 mm distributed within one cropping season is essential for an upland rice crop. This is typical of the areas in the first group. The bimodal zone (second grouping) requires 1000-1200 mm of rain and the heavy rainfall belts receive over 2400 mm rainfall per annum.

Table 18:

Classification and Inventory of Rice Cultivation types in WARDA Member Countries

	Percentage of Total Paddy Areas (1976)		
1. Upland Rice Cultivation	62.5		
1.1 Strictly Upland Cultivation		60	
1.1.1 Hill Rice			5
1.1.2 Flatland Rice			55
1.2 Groundwater Cultivation with Rains		2	
1.3 Groundwater Cultivation without Rains		0.5	0.5
2. Lowland Rice Cultivation	37.5		
2.1 Mangrove Rice Cultivation		10	
2.1.1 Without Tidal Control			2
2.1.2 With Tidal Control			8
2.2 Freshwater Cultivation		27.5	
2.2.1 Without Water Control			22.5
2.2.2 With Partial Water Control			3
2.2.3 With Complete Water Control			2
Total =	100	100	100

A detailed discussion on the West Africa Environment in relation to rice cultivation and WARDA variety and other trials is available in the document entitled "Five Years of WARDA Research (1973-1978).

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VARIETY IMPROVEMENT

Initial Evaluation Tests (IET)

1. Irrigated trial 1977-78 dry season(November-March)

The 400 entries of the 1977 main season IET were tested during the dry season at Suakoko (Liberia) and Kpong (Ghana). Among the 50 top yielding varieties at both sites, the following are common on the basis of grain yield per square meter.

B541B-190-1-1-3
CICA 4
4316
Mahsuri
IR2053-205-2

2. Upland condition 1978 Wet Season (April-October)

The IET was composed of 136 entries. They were made up of semi-tall, tall and some semi-dwarf cultivars having same adaptability under upland condition. The tests were conducted at seven locations though eight locations received sets.

Based on grain yield per square meter, many varieties among the top fifty were found to be common among some sites. Such varieties, found to occur at least in three sites are shown in Table 19. Because of their repeated top positions, these varieties can be considered as more adaptable than the others.

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Table 19 : VARIETIES AMONG TOP 50 ENTRIES THAT OCCURRED IN AT LEAST THREE OF THE FOUR SITES

VARIETY	GRAIN YIELD IN GRAMMES PER SQUARE METER			
	Farakoba (Up.Volta)	Nyankpala (Ghana)	Rokupr (S/Leone)	Sapu (Gambia)
1.B9C-MD-3-3	77.3	500.0	62.0	304.4
2.IRAT 1713	72.0	287.5	52.0	304.4
3.IRAT 958	58.6	237.5	117.3	304.9
4.IRAT 109	52.0	212.5	83.0	307.4
5.IRAT 1293	57.3	200.0	87.3	342.4
6.IRAT 110	92.0	150.0	40.6	371.0
7.IB 98	121.3	300.0	57.3	-
8.IET 2707	9.3	262.5	-	545.1
9.BR51-46-1-C1	-	257.5	74.6	469.6
10.IRAT 2054	56.0	250.0	79.3	-
11.BR 51-46-5	-	240.0	52.0	431.4
12.IRAT 2811	53.3	237.5	121.3	-
13.IB 99	100.0	225.0	49.3	-
14.IRAT 105	14.6	225.0	94.3	-
15.IB 95	90.6	200.0	43.3	-
16.94-6	118.6	187.5	38.3	-
17.2660-5	41.3	185.0	193.3	-
18.2723-3	114.6	160.0	148.6	-
19.2043-9	57.3	150.0	54.0	-
20.IR 2070-199-3-6	-	150.0	37.6	462.2
21.IR2061-465-1-5	41.3	-	51.3	354.2

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3. Irrigated Condition

In 1978, the Irrigated IET was conducted at seven out of the eleven locations that received the trials.

The irrigated IET was composed of 180 varieties of different maturity, plant type and grain quality. Many varieties in most of the sites gave reasonably high grain yields. The grain yields and other data of the top fifty varieties from different sites were tabulated. Considering grain yield per square meter, many varieties among top fifty were found to be common at many of the sites. Varieties, found to occur among the top fifty at least in four among the seven sites are shown in Table 20. Because of their repeated to positions, these varieties can be considered as more adaptable than the others.

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Table 20 : YIELDS OF VARIETIES (gm/sqM) OCCURRING AMONG THE TOP 50 ENTRIES IN AT LEAST FOUR OF THE SEVEN SITES

VARIETY	Kaedi (Mauritania)	Kogoni (Mali)	Libore (Niger)	Mange (S.Leone)	Richard-Toll (Senegal)	Sapu (Gambia)	Suakoko (Liberia)
1.IR2688-43-4-5	433.0	488.8	-	267.3	466.6	507.0	533.3
2.BR 52-90-2	400.0	511.1	1000.0	316.3	466.6	-	640.0
3.KLG 6987-132-2	400.0	480.0	1750.0	239.6	-	505.0	480.0
4.CR95-IR-1512-1	400.0	480.0	-	262.6	533.3	-	533.3
5.IR 2058-435-2-1	570.0	495.5	-	265.6	500.0	-	680.0
6.EEI 6057	467.0	484.4	850.0	-	500.0	707.0	-
7.Vijaya(s)	433.0	-	-	245.0	633.3	612.0	448.0
8.IR 2863-39-2-8	400.0	-	800.0	264.6	466.6	-	586.6
9.S1-20	-	608.8	800.0	298.3	566.6	-	520.0
10.IR 2053-275-6-3	-	746.6	1000.0	245.0	466.6	-	520.0
11.IR480-5-9-3-3	467.0	671.1	800.0	-	500.0	-	-
12.B707D-KN-42-1-2	467.0	484.4	-	235.0	700.0	-	-
13.IR 4819-77-3-2	467.0	455.5	-	247.6	533.3	-	-
14.BR51-91-7	433.0	600.0	1000.0	293.0	-	-	-
15.S18C-20	433.0	568.8	-	-	533.3	-	666.6
16.IR 4568-5-2	433.0	-	-	260.3	500.0	609.5	-
17.IR2071-244-3-2	400.0	497.7	-	272.0	466.6	-	-
18.IR2035-244-3-2	400.0	511.1	-	248.6	566.6	-	-
19.BR167-2B-3	400.0	-	900.0	310.6	466.6	-	-
20.BR160-2B-4	-	-	800.0	-	633.3	541.2	480.0
21.BR 51-119-1/1	-	588.8	-	272.6	466.6	-	560.0
22.B1665B-MR-7SI	-	-	800.0	286.0	466.6	-	453.3

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Coordinated Variety Trials

Introduction: Nine Variety Trials, 2 in the Off Season and 7 in the Main Season covering the broad rice ecologies of the region were conducted during the year under report. Details of the trials, number of locations and entries for each trial are given in Table 21. For the Off Season, the entries were assembled from locally available seeds and hence all were not common to each location, but in the Main Season trials, all entries except the local checks were common.

The grain yield and duration of the top five varieties in each location of the 9 trials are summarised in Table 22.

Location specific response of entries:

The yield figures show the differences in various rice ecologies and also the extent of variation between locations in the same trial. The trends observed during this year are more or less similar to what has been confirmed in earlier years.

While a more critical and precise evaluation of the stability of the entries for each trial on a regional basis is discussed later under Variety Adaptability studies, it is important also to examine the response of the promising entries under local conditions. It will be seen from Table 22 that only a few of the top entries retained their rank at two or more locations in some of the trials, the most striking in this respect being the Main Season Irrigated Trials. On the other extreme, in several other trials none of the entries maintained their rank beyond a single location. The striking fact is that in all the trials the performance of most of the entries varied according to locations and some did not find a place even among the first five. This trend is strongly suggestive of the extent of the environmental variability in each rice ecology prevalent in the region. Most of the physical and biological components of the environment in the rice areas which affect the performance of varieties are known. This knowledge coupled with the selection of appropriate location

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specific varieties which lack wider adaptability should enable us to realise the better of the yield potentials.

Table 21 : DETAILS OF COORDINATED VARIETY TRIALS

Name of trials	Location (No.)	Entries (No.)
Upland Short	10	14
Upland Medium	7	14
Irrigated Short	19	15
Irrigated Medium	20	18
Mangrove Swamp	3	12
Deep-Flooded	4	12
Floating	2	16
Off Season-Short	10	10 to 15
Off Season-Medium	9	10 to 15

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Table 22:

YIELD AND DURATION OF 5 TOP ENTRIES IN COORDINATED VARIETY TRIALS (Under Irrigation)

OFF SEASON (1977-1978)
(1) Short Duration

	Variety	Yield (t/ha)	Duration (days)
Sapu (Gambia)	I Kong Pao	6.85	134
	BR 51-118-2	6.79	139
	NTU 770-7-2	6.60	140
	IET 1996	6.45	149
	Kwang She Sung	6.32	116
Contuboel (Guinea Bissau)	IR2053-241-3-2-3	5.02	149
	IR 630-27	4.97	147
	IR2053-375-1-1-5	4.91	144
	BR 51-319-9	4.75	144
	NTU 770-7-2	4.59	134
Richard-Toll (Senegal)	BR 34-13-5	3.46	173
	Kwang She Sung	3.13	178
	IET 1996	2.99	173
	BR 51-118-2	2.92	185
	NTU 770-7-2	2.88	178
Suakoko (Liberia)	Kwang She Sung	4.58	104
	IR 2053-241-3-2-3	4.04	106
	IR 2053-375-1-1-5	4.03	134
	IR 2035-120-3	3.75	123
	IR 2070-85-1-1	3.26	132
Mange(Sierra Leone)	IR 1529-680-3	5.19	127
	IR 934-450-1	4.41	115
	4448	4.22	136
	IET 1996	3.99	127
	4456	3.92	127

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Table 22 Contd.

	IET 1996	5.91	121
	NTU 770-7-2	5.57	126
Kou Valley	BR 34-13-5	5.38	118
(Upper Volta)	IR 934-450-1	5.20	126
	BR 51-319-9	4.96	130
	4448	5.66	121
	Bhagia	5.07	123
Kpong (Ghana)	CICA 4	4.90	118
	IR 578	4.58	110
	IR 630-27	4.52	107
	TN 1	8.09	135
	NTU 770-7-2	7.32	131
Badeggi (Nigeria)	Kwang She Sung	7.00	107
	BG 34-2	6.86	111
	IR 1614-138-1-3-3	6.76	121
	BR 51-118-2	6.75	97
	BR 51-319-9	5.69	91
Mission Tové	BR 36-13-5	5.45	83
(Togo)	SML AWINI	5.39	95
	IET 1996	5.35	84

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Table 22 Contd. (2) Medium Duration

	Variety	Yield (t/ha)	Duration (days)
	IR 95-23-5-1-3A	6.78	131
	BR 51-49-6	6.44	134
Sapu (Gambia)	IR 32	6.40	161
	BW 196	6.29	155
	IR 790-28-6	6.25	150
	IR 1529-677	7.32	140
	IR 442	6.53	146
Contuboel	BR 52-8-1	6.01	146
(Guinea Bissau)	IR 32	5.02	148
	IR 20	5.00	137
	IR 32	5.20	197
	Hualaga	6.43	179
Richard-Toll	BW 196	4.55	181
(Senegal)	IR 1416-131-5	4.39	183
	BR 51-49-6	3.96	183
	IR 1416-131-5	4.71	130
	IR 5	4.01	148
Suakoko(Liberia)	IR 1529-677	3.90	130
	Suakoko 8	3.88	138
	IR 32	3.79	
	Mange 2	4.86	128
	IR 32	4.74	128
Mange(Sierra Leone)	BW 196	4.36	128
	ROK 6	4.32	128
	IR 2068-65-3	4.26	128
	Vijaya	4.10	150
	IR 1416-131-5	4.03	143
Kou Valley	IR 937-55-3	3.98	143
(Upper Volta)	IET 2885	3.83	150
	IR 269-26-3-3	3.70	150

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Table 22: Contd.

	IR 32	5.31	122
	IR 790-28-6	5.07	113
Kpong (Ghana)	IR 937-55-3	4.52	115
	Vijaya	4.52	119
	BR 51-49-6	4.44	119
	IR 1416-131-5	6.86	143
	IR 2681-131-5-6	6.16	128
Badeggi (Nigeria)	IR 20	5.74	138
	IR 32	5.74	147
	FARO 16	5.60	141

IR 32: 1st in 2 locations

IR 1416-131-5: 1st in 2 locations.

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Table 22 Contd.

II. MAIN SEASON - UPLAND

(3) Short Duration

	Variety	Yield (t/ha)	Duration (days)
	IR 30	6.30	113
	IRAT 10	5.73	105
Sapu (Gambia)	IR 1480-116-3-3	5.65	126
	ADNY 8	5.65	127
	B9C-MD-3-3	5.20	113
	144 B/9	4.62	92
	M 55	4.57	98
Sefa (Senegal)	B57C-MD-10-2	4.22	107
	M 18	4.17	101
	IR 1480-116-3-3	3.53	108
	B57C-MD-10-2	1.34	129
	M 18	1.34	108
Rokupr (Sierra	ADNY 7	1.30	121
Leone)	ADNY 8	1.26	126
	IR 747 B2-6-3	1.25	106
	M 18	2.33	117
	ADNY 8	1.77	127
Suakoko(Liberia)	M 55	1.61	120
	ADNY 7	1.51	127
	LAC 23 (Red)	1.32	127
	M 55	1.91	112
	IRAT 10	1.87	95
Farakoba (U/Volta)	M 18	1.33	112
	IR 1480-116-3-3	0.94	-
	IR 30	0.40	115

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Table 22 Contd.

	ADNY 8	1.92	105
	M 55	1.67	98
ODIENNE (Ivory Coast)	M 18	1.64	110
	IR 1480-116-3-3	1.27	60
	ADNY 7	1.17	86
	ADNY 8	1.98	153
	Tongil 917	1.90	115
Moor Plantation	ADNY 7	1.81	155
(Nigeria)	IR 1480-116-3-3	1.72	120
	AUS 61	1.69	118
	SE 314G	1.78	100
	SE 319G	1.29	99
Nyankpala (Ghana)	IR 442	1.25	124
	AUS 61	1.18	105
	IR 747-B2-6-3	0.68	98
	B57C-MD-10-2	3.00	126
	ADNY 8	2.72	124
Sotoubua (Togo)	B9C-MB-3-3	2.39	111
	AUS 61	2.29	108
	ADNY 7	2.27	124

B57C-MD-10-2: 1st in 2 locations

ADNY 8: 1st in 2 locations

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Table 22 Contd. (4) Upland Medium Duration

	Variety	Yield (t/ha)	Duration (days)
Sapu (Gambia)	BR 51-331-4	4.39	139
	IR 1529-680-3	4.35	126
	IR 2035-108-2	4.30	132
	MRC172-9	4.22	126
	4455	4.13	126
Suakoko (Liberia)	4418	2.70	123
	MRC 172-9	2.66	123
	IR 2035-250-3	2.07	125
	IR 2035-108-2	2.05	125
	LAC 23 (White)	1.93	127
Rokupr (Sierra - Leone)	AXBG 7.3	2.27	144
	4418	2.25	122
	IR 2035-108-2	2.16	132
	IRAT 30	1.94	112
	MRC 172-9	184	122
ODIENNE (Ivory Coast)	IR 2035-108-2	4.19	-
	IRAT 30	2.01	-
	4418	1.99	-
	4455	1.78	-
	IGUAPE CATETO	1.46	-
Nyankpala (Ghana)	IR 2035-108-2	2.83	130
	4418	2.45	117
	4320	2.16	130
	IR 1529-680-3	2.12	128
	4455	2.03	127

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Table 22 contd.

	MRC 172-9	3.61	124
	IR 1529-680-3	3.58	124
Sotoubua (Togo)	4455	3.42	124
	IR 2035-108-2	3.17	124
	IR 3880-17	3.15	123
	4418	2.01	-
	4320	1.76	-
INA (Benin)	GAMBIAKA	1.72	-
	IR 934-55-9	1.69	-
	IR 1529-242-2	1.54	-

4418: 1st in 2 locations

IR 2035-108-2: 1st in 2 locations

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Table 22 contd. MAIN SEASON - IRRIGATED

(5) Short Duration

	Variety	Yield (t/ha)	Duration (days)
Sapu (Gambia)	4456	7.05	124
	BG 90-2	6.15	125
	4448	6.00	128
	I Kong Pao	5.84	120
	BR 51-46-5	5.74	135
Contuboel (G.Bissau)	BG 90-2	4.80	118
	ADNY II	4.20	120
	4448	4.19	137
	BR 51-46-5	3.80	133
	BW 78	3.11	132
Kaedi (Mauritania)	BG 90-2	9.17	130
	ADNY II	7.95	132
	BR 36-13-5	7.83	115
	NTU 770-7-2	7.75	145
	IET 2775	7.70	127
Richard-Toll (Senegal)	NTU 770-7-2	6.10	136
	IR 934-450-5	5.79	121
	4448	5.66	145
	BR 51-46-5	5.62	131
	4456	5.38	131
Suakoko (Liberia)	BG 90-2	5.91	129
	ADNY II	5.32	128
	BP 176/9 x DAWN	4.79	124
	IR2071-586-6-5-3	4.65	140
	BW 78	4.62	140

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Table 22 contd.

	4448	4.00	127
	BG 90-2	3.85	127
Mange (Sierra -	ADNY II	3.39	127
Leone)	NTU 770-7-2	3.35	127
	BR 51-46-5	3.32	127
	IR 28	4.12	104
	BG 90-2	3.76	126
Vallee du Kou	IET 1444	3.60	108
(Upper Volta)	4456	3.46	125
	ADNY 2	2.93	114
	BG 90-2	8.12	115
	4456	7.03	107
Korhogo (Ivory	BR 51-46-5	7.01	108
Coast	CS 5	6.71	103
	ADNY II	6.47	100
	4456	4.43	101
	BW 78	4.28	100
San-Pedro	BG 90-2	4.10	99
(Ivory Coast)	4448	4.04	104
	BR 51-46	4.02	93
	H 15-23-DA	4.70	136
	BW 78	4.17	135
Kogoni (Mali)	BR 51-46-5	4.01	126
	4448	3.72	129
	BG 90-2	3.63	127
	BR 51-46-5	5.43	103
	BW 78	5.31	153
Kpong (Ghana)	ADNY II	4.76	118
	BG 90-2	4.70	132
	IR 2071-586-5-6-3	4.45	142

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Table 22 contd.

	IR 2071-586-5-6-3	7.03	128
	BR 51-46-5	6.03	131
Badeggi (Nigeria)	4448	5.83	127
	BW 78	5.36	126
	4456	5.32	128
	BP 176/9 x DAWN	5.40	88
	BR 51-46-5	5.01	105
Bende (Nigeria)	BG 90-2	4.86	92
	IR 2071-586-5-6-3	4.78	94
	IET 2775	4.09	88
	4448	5.58	127
	ADNY II	5.31	127
Amou-Oblo (Togo)	BW 78	4.90	127
	BG 90-2	4.89	126
	BR 51-46-5	4.59	128
	BW 78	3.70	135
	BR 36-13-5	3.50	119
Dapango (Togo)	IET 1444	3.10	110
	IR 28	2.97	110
	NTU 770-7-2	2.87	125
	IR 2035-250-3	6.25	135
	IET 1444	4.31	118
Mission Tove (Togo)	BR 36-13-5	4.31	119
	4456	3.87	128
	IR 934-450-5	3.75	117
	BW 78	2.78	133
	ADNY II	2.75	129
Houeda (Benin)	IR 442	2.51	147
	BR 51-46-5	2.33	144
	4448	2.08	118

...../76....

Table 22 contd.

	BG 90-2	5.86	132
	ADNY II	5.79	137
Sagbovi-Dome	BW 78	5.11	139
(Benin)	IR 2071-586-5-6-3	4.82	147
	4456	4.52	132
	BR 51-46-5	4.90	-
	BG 90-2	4.81	-
Libore (Niger)	4456	4.28	-
	IR 2035-250-3	4.24	-
	BW 78	4.07	-

4456 : lst in 2 locations
BG 90-2 : lst in 5 locations

4448 : lst in 2 locations

BR 51-46-5: lst in 2 locations

BW 78: lst in 2 locations

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Table 22 contd.

(6) Medium Duration

	Variety	Yield (t/ha)	Duration (days)
Sapu (Gambia)	BG 374-1	6.48	125
	BG 51-49-6	6.46	146
	ADNY 2	6.36	132
	BR 52-8-1	5.91	159
	IR 1529-680-3	5.73	129
Contoboel (G/Bissau)	BW 196	3.15	124
	IET 2885	3.13	131
	BR 52-8-1	3.04	146
	BR 51-49-6	2.96	144
	4414	2.96	129
Kaedi (Mauritania)	IR 1529-680-3	6.57	132
	BW 196	5.54	137
	BG 374-1	5.45	134
	BR 52-8-1	5.04	136
	TN 1	4.88	110
Djibelor (senegal)	BR 51-118-2	3.91	136
	Improved Mahsuri	3.83	132
	BR 51-319-9	3.79	136
	BR 51-49-6	3.74	140
	BW 191	3.66	144
Richard-Toll (Senegal)	IR 2070-414-3-9	7.36	146
	IR 1529-680-3	7.12	148
	BG 374-1	7.08	144
	4414	6.85	145
	IET 1996	6.81	145

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Table 22 contd.

	BR 51-118-2	5.25	144
	IR 1416-131-5	5.11	140
Suakoko (Liberia)	BW 191	4.48	145
	IR 2058-435-2-1	4.60	145
	BR 51-49-6	4.55	143
	IET 1996	4.28	127
	Suakoko 8	4.02	127
Mange (Sierra Leone)	BG 374-1	3.97	127
	BR 51-49-6	3.92	127
	BW 196	3.72	127
	4414	170	117
	BR 51-319-9	4.14	126
Vallee du Kou	IR 1529-680-3	4.03	126
(Upper Volta)	BW 196	3.86	126
	IET 2885	3.73	130
	BG 374-1	8.18	-
	BG 375-1	7.02	-
Korhogo (I/Coast)	BW 196	6.98	-
	BR 51-118-2	6.61	-
	JAYA	6.43	-
	BR 51-118-2	5.22	109
	BW 191	4.70	118
San-Pedro (I/Coast)	BR 51-319-9	4.62	102
	BR 52-8-1	4.57	106
	BW 196	4.55	112
	BW 191	4.88	140
	D 52-37	4.86	146
Kogoni (Mali)	BR 52-8-1	4.54	123
	BW 196	4.33	135
	IR 2053-241-3-2-3	4.29	140

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Table 22 contd.

	BR 51-118-2	4.92	125
	IET 2885	4.85	133
Kpong (Ghana)	IET 1996	4.85	131
	BR 51-319-9	4.80	119
	BW 1	4.68	134
	BW 196	6.64	158
	BR 51-118-2	6.35	157
Badeggi (Nigeria)	BW 191	6.27	138
	BR 52-8-1	6.09	166
	BR 51-319-9	6.08	126
	4414	6.71	132
	BR 52-8-1	6.57	130
Amou-Oblo (Togo)	BR 51-49-6	6.22	134
	BG 374-1	6.15	132
	BW 196	6.08	136
	IET 1996	3.35	141
	BR 51-319-9	3.22	143
Dapango (Togo)	BR 51-49-6	3.17	155
	BR 52-8-1	2.85	141
	BG 374-1	2.68	141
	BW 196	8.12	131
	BG 374-1	7.87	121
Mission Tove (Togo)	BR 51-319-9	7.57	125
	BR 51-49-6	7.53	133
	IR 20	7.46	122
	BR 51-49-6	2.67	147
	IET 1996	2.48	133
Houeda (Benin)	IR 8	2.45	133
	IR 442	2.43	132
	IET 2885	2.39	135

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Table 22 contd.

	IET 1996	5.23	139
	BW 196	5.15	150
Sagbovi-Dome (Benin)	BR 51-118-2	4.82	139
	4414	4.70	137
	BR 52-8-1	4.67	139
	BR 51-118-2	4.02	-
	IR 1529-680-3	3.69	-
Libore (Niger)	IR 2053-241-3-2-3	3.30	-
	BW 196	3.16	-
	BR 51-319-9	3.10	-

BG 374-1 : lst in 2 locations

BW 196 : lst in 3 locations

BR 51-118-2: lst in 6 locations

IET 1996 : lst in 3 locations

4414 : lst in 2 locations

...../81...

Table 22 contd.

(7) Mangrove Swamp Conditions

	Variety	Yield (t/ha)	Duration (days)
Jenoi (Gambia)	C13.F1	2.94	138
	ROK 5	2.74	138
	DA 29	2.43	139
	BD 2	2.35	148
	N'Kumbou N'dingo	2.33	151
Caboxangue (G/Bissau)	GC 23	6.83	173
	Atanha	6.45	156
	Mange 2	6.45	144
	Mahsuri	6.40	142
	Improve Mahsuri	6.21	142
Rokupr (S/Leone)	ROK 5	3.43	143
	C 13 F1	3.39	144
	DA-29	3.37	144
	BL 4 B	3.36	185
	ROK 4	3.35	142

(8) Deep Flooded Conditions

Sapu Jahally (Gambia)	BKN 6323	3.58	131
	ROK 5	3.38	131
	Mahsuri	3.03	131
	IR 442-2-58	2.94	130
	MSP II	2.83	158
	Banjul	2.53	131
Longorala (Mali)	DM 16	1.18	145
	IR 4442	1.01	135
	BKN 6323	0.95	140
	T 442-36	0.87	135
	DM 12	0.86	130
	Diou	0.67	150

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Table 22 contd.

	Variety	Yield (t/ha)	Duration (days)
	MSP II	6.19	164
	BKN 6323	5.61	158
Koko-Moli (Niger)	AA8A	5.56	158
	DM 12	5.40	153
	T 442-36	5.34	147
(9)	Floating Conditions		
	T 442-36	2.36	145
	BH 2	2.33	146
Mopti (Mali)	Khao Gaew	2.19	158
(84-115cm:	DM 12	2.01	140
Water depth)	MSP II	1.88	128
Mopti (Mali)	Indochine Blanc	3.22	157
(85-105cm	Mali Sawn	3.13	170
Water depth)	Neang Kheaw 5	3.07	168
	FRRS 43/3	2.99	151
	DM 16	2.89	146
	IM 16	4.81	157
	Indochine 70	4.77	145
Daikena (Niger)	BH 2	4.67	144
	Malobodian	4.44	149
	Indochine Blanc	4.25	145

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VARIETY ADAPTABILITY STUDY

A simple linear regression method was used to study the adaptability of WARDA nominated varieties throughout the West African region. For each trial, the mean yields of each variety at the different locations regressed on environmental indices provided estimates of the adaptability parameters (the overall mean yield and regression coefficient) for that variety. The quantities used as environmental indices are the mean yields of the trial at the various locations.

Based on the adaptability parameters, the varieties have been classified into three categories as follows:

Category 1: Varieties which yield above average in all environments. These varieties have high mean yields and regression coefficients close to or equal to one.

Category 2: Varieties that do exceptionally well in low yield environments but do poorly in the high yield environments. These varieties are characterized by average (or moderate) mean yields and regression coefficients much lower than one or close to zero.

Category 3: Varieties which do exceptionally well in high yield environments but do poorly in the low yield environments. These are characterized by average (or moderate) to high mean yields and regression coefficiently much greater than one.

Others: Varieties that do not clearly fall into any of the three categories above.

The varieties in each trial are grouped below into the different categories. Within each category (except for "others") the list is according to descending order of superiority.

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1. Irrigated Short: Off Season 1977/78

Category 1: NTU 770-7-2, IET 1996, 4448, BR 51-319-9, BR 34-13-5

Category 2: IR 2053-375-1-1-5

Category 3: BR 51-118-2, IR 934-450-1

Others : IR 630-27, BAHAGIA, IR 2035-250-3, IR 28, IR 2053-241-3-2-3.

2. Irrigated Medium: Off Season 1977/78

Category 1: IR 1416-131-5, IR 32, BW 196, IR 790-28-6, BR 51-49-6.

Category 2: IR 1526-680-3

Category 3: IR 1529-677, IR 20, BR 52-8-1, 4456.

Others : IR 2063-65-3, HUALLAGA, MAHSURI, IMP. MAHSURI.

3. Rainfed Short: Main Season 1978

Category 1: ADNY 8, IR 30, IR 1480-116-3-3, SE 319G, ADNY 7, B 57C-MD-10-2.

Category 2: M 55.

Others : IR 747 B_2-6-3, M 18, SE 314G, 4367, AUS 61, IR 2053-205-3.

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4. Rainfed Medium: Main Season 1978

Category 1: MRC 172-9, IR 1529-680-3, 4455, IR 934-55-9.

Category 2: IR 2035-108-2, 4418.

Category 3: BR 51-331-4, IR 3880-17, IR 1529-242-2, IR 2035-250-3.

Others : IRAT 13, 4320, LAC 23 (White), B 459b-Pn-4-5-7.

5. Irrigated Short: Main Season 1978

Category 1: BG 90-2, BR 51-46-5, ADNY II, 4448.

Category 2: BW 78.

Category 3: 4456, IET 2775.

Others : BR 36-13-5, IR 934-450-5, NTU 770-7-2, IR 2035-250-3, IET 1444, BPJ76^{9}x DAWN, IR 28.

6. Irrigated Medium: Main Season 1978

Category 1: BR 51-118-2, BW 196, BR 51-49-6, BR 52-8-1, BR 51-319-9, BW 191, IR 1529-680-3, BG 375-1, 4414.

Category 2: -

Category 3: BG 374-1

Others : IET 2885, IMP. MAHSURI, IET 1996, IR 2053-241-3-2 IR 2070-414-3-9.

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COORDINATED PLANT PROTECTION TRIALS
Weed Control Trials

A. Rainfed:

The trials was conducted at Sapu, The Gambia (Zone I); Suakoko, Liberia and Rokupr, Sierra Leone (Zone II); Odienne, Ivory Coast and Farako-Ba, Upper Volta (Zone III).

The performance of the four best weed control treatments at various location (except Suakoko) is presented in Table 23. At most locations, hand weeding was generally superior. This confirms previous observation (1974-1977). However, some of the herbicides performed as well as hand weeding treatment (BAS-454-04H at Rokupr, Odienne and Farako-Ba; Tamariz at Odienne and Farako-Ba; Ronstar at Odienne; and Surcopur + Tribunil at Sapu). All the above weed control treatments at various sites (except at Rokupr) gave higher yields than the control.

At Suakoko, Tribunil/Surcopur, Machete EC, Machete 5G, BAS-454-02H and Preforan showed some promise in controlling weeds.

B. Irrigated/Mangrove

The trial was conducted at Djibelor, Senegal, (Zone I); Suakoko, Liberia and Rokupr Mangrove, Sierra Leone (Zone II); Vallee du Kou, Upper Volta (Zone III).

The performance of the four best weed control treatments at various locations is presented in Table 24. Unlike rainfed conditions, irrigation with good land preparation offered the advantage of water control and natural suppression of weeds.

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Table 23: GRAIN YIELD AND EFFICIENCY OF FOUR BEST WEED CONTROL TREATMENTS UNDER RAINFED CONDITIONS - MAIN SEASON 1978

Location	Control yield (t/ha)	1st			2nd			3rd			4th		
		Yield increase over control		Weed cont. effic. (%)	Yield increase over control		Weed cont. effic (%)	Yield increase over control		Weed cont. effic (%)	Yield increase over control		Weed cont. effic. (%)
		t/ha	%		t/ha	%		t/ha	%		t/ha	%	
SAPU	0	2.15	2150	97.0	1.62	1620	99.4	1.42	1420	97.9	1.33	1330	45.7
		Hand Weeding at 10 and 30 DARE			Weed free			Hand Weeding at 21 & 40 DARE			Tribunil + Surcopur		
ROKUPR	1.23	0.28	22.8	79.0	0.22	17.9	45.2	0.04	3.5	53.1	-	-	-
		Hand Weeding			Weed free			BAS-454-04H			-	-	-
ODIENNE	0.41	1.21	295.1	-	1.19	290.2	-	1.05	256.1	-	0.93	226.8	-
		RONSTAR			BAS-454-04H			TAMARIZ			Weed free		
FARAKO-BA	0.18	1.52	844.9	-	1.44	800.0	-	1.03	572.2	-	0.89	494.4	-
		Weed free			Hand Weeding at 20 and 40 DAS			Tamariz			BAS-454-04H		

DARE = Days after rice emergence

DAS = Days after sowing

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Table 24:

GRAIN YIELD OF FOUR BEST WEED CONTROL TREATMENTS UNDER IRRIGATED/MANGROVE CONDITIONS-MAIN SEASON 1978

LOCATION	Control yield (t/ha)	1st		2nd		3rd		4th	
		Yield increase over control		Yield increase over control		Yield increase over control		Yield increase over control	
		t/ha	%	t/ha	%	t/ha	%	t/ha	%
DJIBELOR	3.51	0.30	8.5	0.15	4.2	0.15	4.2	0.11	3.1
		Stam F 34 (8)*		Weed free		BAS-454-03H (5)*		Stam Super A (9)*	
SUAKOKO	2.70	1.02	37.9	1.00	37.0	0.94	34.8	0.67	24.8
		Hand Weeding twice		Machete EC		Machete 5G		Stam F 34	
ROKUPR (MANGROVE)	2.07	0.80	38.6	0.76	36.7	0.56	27.0	0.43	20.8
		Tribunil + Surcopur		Basagram KV + Stam F 34		Destung G		Hand Weeding	
VALLEE DU KOU	3.13	1.13	36.1	0.74	23.6	0.66	21.1	0.59	18.8
		Tamariz		BAS-454-04H		Machete EC		Tribunil + Surcopur	

* Weed control rating at 5 weeks after transplanting:

For example, at Djibelor various weed control treatments failed to give significant yield increase over the control. On the other hand, at Suakoko, and Vallee du kou four best weed control treatments gave 25.2 to 37.9% and 19 to 36% respectively. Yield increase over the control yield of 2.70 and 3.1 t/ha respectively. It seemed that even under irrigated conditions, especially where water control cannot be accomplished satisfactorily weed control can help in getting much higher yields. Similar to the rainfed trial, some chemical herbicides under irrigated conditions performed as well as hand weeding treatments as far as grain yield were concerned. (Machete EC and Machete 5G at Suakoko, while Tamariz at Vallee du kou was better than hand weeding).

At Rokupr, under mangrove swamp conditions, Tribunil + Surcopur and Basagran KV + Stam 34 gave 38.1 and 36.4% respectively yield increase over the control yield of 2.07 t/ha. The above two herbicides also gave greater yields than the hand weeding treatment. Previous results of weed control trials showed that under mangrove swamp conditions good land preparation before transplanting offered adequate weed control and consequently higher grain yield.

Insecticide Trials

A. Rainfed

The trials was conducted at Rokupr (Zone II) and Farako-Ba (Zone III). In these trials the effectiveness of the systemic insecticide Furadan was tested.

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At Rokupr Furadan 3G (1.2 g a.i.) failed to promote higher grain yield. While at Farako-Ba, Furadan 3G (1.2 kg. a.i./ha) applied either thrice (1/3rd each at 10,30 and 60 DAS) or twice (½ each at 10 and 60 DAS) produced significantly greater yields than the control. Furadan applied twice and thrice gave 46.5 and 56.3% yield increase respectively over the control yield of 4.25 t/ha.

B. Irrigated/Mangrove

Off Season (1977/78)

At Dawhenya, Ghana (Zone IV) Furadan 3G at the rate of 2.4 kg a.i./ha gave significantly greater yield than the control (39.2% yield increase over the control yield of 5.83 t/ha). While at Vallee du Kou (Zone III), Furadan (1.2 and 2.4 kg a.i./ ha) failed to promote higher grain yield.

Main Season

The trial was conducted at Djibelor (Zone I) Rokupr Mangrove (Zone II), Valle du Kou and Korhogo (Zone III).

At Djibelor, Rokupr Mangrove and Vallee du Kou beneficial effects of Furadan in increasing grain yields were not recorded. This suggests that incidence of insect pest was not serious during the 1978 main season at the above three test locations. While at Korhogo, two split applications of Furadan 3G at the rate of 1.2 kg a.i./ha (i.e. 0.42 kg a.i./ha at 7 DAT and 0.78 kg a.i./ha at 30 DAT) gave significantly greater yield than the control (91.6% yield increase over control yield of 2.99 t/ha). It was noted at Korhogo that stemborer attack was severe on the control treatment and also Gall Midge was specially responsible for major damage to irrigated rice during the 1978 main season.

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SPECIAL RESEARCH PROJECTS

I. Deep-Flooded/Floating Rice (Mopti - Mali)

Introduction

A multi-disciplinary team has been formed which includes specialists in variety improvement, agronomists, weed scientists, entomologists and pre-extension work.

During this season, the trials were carried out in the only available area which was very uneven. The regions where floating rice is grown in Mali were visited.

Research activities

1) Rainfall and flood

This season has been characterised by rainfall higher than the mean for a 37 year period. The rainfall was 583.9mm i.e. 5% higher than the mean of 558mm. The high rainfall was very unevenly distributed over the whole season. Floods were heavy and came early. Flooding took place on the 2nd of September. The maximum levels recorded by the gauge on October 14 at different points of the station's experimental area varied between 120 and 160 cm.

2) Variety Improvement

a. Hybridization programme

Few crosses made in 1977 were grown. Three of the crosses were in F_1 stage in 1978. These are BR/Mali Sawn, IR790-28-6/Mali Sawn and IR790-28-6/Son Lon A. AA8A/Khao Yai 14-22-103 was in F_2 stage. It is planned to request IRRI, Thailand and WARDA Headquarters to assist in making appropriate crosses for the station. Selection from the segregating populations will however be made at the station in Mopti.

b. Comparative variety trials

Seven varieties were selected from the International Deep Water Rice Observation Nursery and compared with the Khao Gaew, DM16 and DA29 varieties. The tolerance of the plants to drought in the field was evaluated.

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The results obtained are shown in Table 25 below. The coefficient of variation is high (37.05%). This is due to the heterogeneity of the land. No significant difference was found between the varieties. Out of the 10 varieties, DM 16 would seem to be the most resistant to drought. The Thai lines BKN 7022-10-1-4, BKN 6986-167 and BKN 7022-6-4, the same score as the control Khac Gaew. Other lines and DA 29 performed better than the control.

Table 25 : YIELD IN KG/HA AND OTHER AGRONOMIC CHARACTERISTICS OF THE NEWLY INTRODUCED VARIETIES

Entries	Days Maturity	Height	Leaf-eating caterpillars*	Stem Borers*	Drought*	Yield kg/ha
1.BKN 6986-38-1	150	144	1	1	3	2,522
2.BKN 6986-105-P	146	138	3	1	3	2,203
3.DM 16	140	199	3	3	1	2,097
4.Khao Gaew	155	197	3	3	5	2,032
5.D.A. 29	140	189	3	1	3	1,890
6.BKN 6987-108-3	150	163	3	1	3	1,800
7.BKN 6986-81-3	151	173	3	1	3	1,734
8.BKN 7022-10-1-4	145	143	3	1	5	1,719
9.BKN 6986-167	150	186	1	1	5	1,694
10.BKN 7022-6-4	148	152	3	1	5	1,555
C.V.						37.05%
N.S.						

* IRRI scale 0 to 9

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3. Agronomy

a) Effect of sowing date

The seeding date is a crucial factor in floating rice cultivation. The rice emerges under rainfed conditions and the floods provide water for the rest of its development. Khao Gaew, Nang Kieu and Mali Sawn varieties were seeded at different dates (1,10,20, 31 July, 10 and 20 August). The rice emerged at the same time in the plots sown on the first two dates and there was much evidence of hard soil crust and competition from O.barthii. By August 4, the first 3 treatments had attained roughly the same height (14 cm).

The plant density in the plot sown on the 3rd date was higher and more uniform. Despite the high water levels during the twenty days of September (170 compared with the normal level of 81.7), the seeds sown on August 20 were not able to stand the flood. The varieties sown on this date perished on October 20 when the water depth reached 96 cm.

Seeding from July 20 onwards could reduce the competition from O.barthii considerably, if various methods of soils preparations or pre-sowing herbicides with a minimal residual effect are used. The sowing date did not have any effect on the 50% flowering dates. In the case of the Khao Gaew and Nang Kieu varieties this occurred between November 27 and 30 and took place the following week for Mali Sawn.

During this season, there was no relationship between the incidence of disease or pest attacks and different sowing dates. Mali Sawn variety was more susceptible to attack by borers: 14% white head, whereas in the case of the other two varieties such damage was hardly noticed.

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The highest yields of 2.94, 3.00 and 3.53 t/ha for Khao Gaew, Nang Kiew and Mali Sawn respectively were obtained from July 20 sowing.

A drop in yield of 43% was recorded for the plot sown on August 10 as compared with those sown on July 20. Seeding after August 10 in the middle zone at Mopti is a serious risk. Hard soil crust and weeds affect the seeds sown earlier.

Delaying sowing until July 20 allows for a better organization of weed control.

b) Effect of spacing on the yield of floating rice

Line sowing (row spacing of 25,30, 35, 40 and 45 cm) and broadcast sowing were tried, using floating rice - Khae Gaew. Weeding in plots, where broadcast sowing had been done was more painstaking because the young plants of cultivated rice resembled wild rice plants. There was no significant difference between the paddy yields of the various treatments. The yield varied between 3.21 t/ha in 35 cm spacing and 3.60 t/ha in 40 cm spacing.

Line sowing is more advantageous because it makes weeding easier. The choice of spacing depends on the equipment available (drill and hoe).

c) Effect of initial seeding density on floating rice

Khao Gaew variety was sown at different rates : 40, 60, 80, 100 and 120 kg of seeds/ha.

Plots in which 80 kg of seeds and above were sown had better plant growth, although plants suffered considerably from drought in August. The number of panicles varied between 175 and 180/square metre. There was no significant difference in the yields of the various treatments.

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The yield varied between 3.3 t/ha in 40 kg and 3.7 t/ha in 100 kg seeding rate.

Low densities (40-60 kg/ha) are preferable when there is a risk of drought or on very fertile land but in practice, low density cultivation requires adequate soil preparation; good sowing techniques and good weed control.

d) Soil analysis at the WARDA Mopti-North Station

Last year samples of soil were taken at seeding from depths of 0-15 cm and sent to the soils laboratory at the Food Crops and Oilseeds Station, Sotuba-Bamako. The results obtained were as follows:

There is very little difference in the soils of the various areas at the WARDA station:

- the percentage of clay is very high (52-76%)
- the nitrogen level is quite good (0. 10-0.12%)
- the organic matter content is relatively high 1.39-2.39%
- the C/N ratio is high (12.64-20.00)
- the available phosphorous is low
- there are large quantities of potassium (130-300 ppm)
- the soil is acidic. Its pH varies between 4.57 and 5.20

e) Effects of rates of nitrogen on floating rice

Different doses of nitrogen were used on the Khao Gaew variety (0,30, 60,90, 120 and 150 kg N/ha). The mineral supplement, 40 kg P_2O_5 and 40 kg K_2O/ha applied at the beginning of tillering.

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All the nitrogen was applied one week before the flood water reached the plot. The main stems of the zero N and 30 N plants had an average of 8 internodes, whereas those to which higher doses were applied had 12. In the case of the latter, the number of roots per node (3-5), their length (5-10 cm) and their rootlets system were higher than those of the other treatments. The treatments did not affect the flowering and maturing dates of this variety. There was a linear relationship between yield and rates of N(Y= 2530 + 10N; r= + 0.99). For each kilo of nitrogen added there was an average increase of 10 kg of paddy.

This low yield response to nitrogen in comparison with the irrigated varieties which produce up to 20 kg of paddy/kg N is due to the nature of the floating rice and the agroclimatic conditions in this region. The 30 N treatment which produced upto 15.8 kg of paddy/kg of nitrogen is relatively the most economical dose.

Nitrogen fertilizers help to prevent flood damage by lengthening the stem of floating rice plants.

f) Effect of Fertilizer application on Khao Gaew

The various fertilization practices used by operation Rice Mopti farmers were compared with the formula recommended by the Mali Agronomic Research Services:

i. without fertilizer (control)

ii. 100 kg/ha of ammonium phosphate at sowing and 100 kg of urea before the floods (recommended formula)

iii. 100 kg/ha of ammounium phosphate at sowing and 50 kg/ha urea before floods.

iv. 100 kg/ha of ammonium phosphate at sowing.

v. 100 kg/ha of ammonium phosphate at tillering.

vi. 100 kg/ha of urea before floods.

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Apart from the plant height, there was no significant difference between the characteristics observed in the various treatments. The initial fertility of the plots seemed to be high and this appears to have masked the effect of the fertilizer. This trial will be repeated next season.

4) Weed Science

a) Collection and Identification of weeds in floating and deep-flooding ricefields

Weeds were collected in the farmers' fields as from September: this is the flowering period of weeds. They were identified, pressed and preserved in a herbarium. During this season, weed studies here extended to the Operation Rice Segou and the Gao dry season rice Sorghum Campaign.

In the highland area of Segou, there were many weeds, which were not found at the station. At Gao, Echinochloa stagnina was seen in farmers' fields, whereas in Mopti it was only found in deep ponds and canals. The following weeds were added to the collection, bringing the number of species from 22 upto 29.

Achranthes aspera L (Amaranthacea)
Scirpus praelongatus Poir (Cyperaceae)
Caperonia sp. (Euphorbiaceae)
Paspalum scrobiculatum L (Gramineae)
Vossia cuspidata Griff (Gramineae)
Utricularia stellaris L (Lentibularicaceae)
Borreria filifolia (S and Th) K.Schum (Rubiaceae)

b) Study of vegetative cycle of weeds

The trials were performed in plastic buckets with the water depth at approximately 2cm. The wild rices O.longistaminata, O.barthii, O.glaberrima and O.stapfii were compared with the cultivated rice O.sativa (T442-36 and BH2).

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Results obtained this season tally with those obtained in 1977. Certain agronomic traits (plant heights and number of tillers) were affected by water depth. More than 80% of the O.Sativa (T442-36, BH2) emerged 5 days after sowing, while some of the O.longistaminata and O.barthii plants emerged before the seventh day.

This early emergence does not lead to earlier tillering. O.longistaminata grows slowly at the beginning of its vegetative cycle. From the 45th day after sowing it is taller than all the other treatments. The annual wild rices produce more tillers than the other treatments. The maximum number of tillers was obtained about 66 days after sowing.

The annual wild rices mature much earlier than T442-36 and BH2. O.barthii was the first to mature (93 days after sowing). This study has shown that there are very few differences in agronomic characteristics which can be used to facilitate weed control. Wild rices were found to be well adapted to the ecology and some characteristics such as early maturing and spontaneous shattering before maturity contribute toward keeping the rice field in a perpetual state of infestation.

c) Study of dormancy; Gradual germination test

The dormancy of seeds is a characteristics which enables weeds to survive in the soil and continue to cause serious infestation despite frequent ploughing carried out during the growing period. Gradual germination tests were carried out every 15 days on filter paper in Petri dishes. Each petri dish contained 25 seeds. Counting was done 7 days after the beginning of each test. The seeds were harvested on November 15,1977. Five months after harvesting (22 April) O.stapfii showed evidence of more than 80% germination whereas O.longistaminata and O.barthii were still dormant.

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At no stage during the entire test period did the percentage of germination exceed 51% for O.barthii or 16% for O.longistaminata. In mid-July (sowing period) the percentage of germination for O.barthii reached only 35%. These results clearly show why it is difficult to eradicate these wild rices.

d) Effect of depth of placement on the germination of O.barthii

Soil preparation techniques can have an effect on the seeds of weeds: they either bury them deeper into the soil or bring them up to the surface. A trial was carried out in plastic buckets with sand as the medium. Each bucket contained 25 grains of O.barthii and planted at various depths (o, 2.5, 7.5, 10 and 12.5 cm).

The best germination was obtained at a depth of 2.5 cm. Two weeks after sowing there was no significant difference between the 0 to 7.5 cm treatments. This trial will be repeated in the field in 1979.

e) O.longistaminata control methods

The aim of this trial was to compare the effectiveness of different treatments on the traditional method of controlling O.longistaminata wild rice with rhizomes, in order to cross-check the results obtained in 1977. The chemical treatment were carried out using Tecnoma with 333 litres/ha of water.

As in 1977, ploughing just before floods was not effective. When this is combined with one undercutting the result are equal to those of other treatments but statistically inferior to those obtained when 5.0 kg a.i./ha glyphosate was used.

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The only treatment which produced better results than the traditional method of two undercuttings was the use of 5.0 kg a.i./ha of glyphosate. One month after the first undercutting there were very few ratoons (1.2 feet/m^2) and the time spent on labour was 6 hours per ha.

The combination of chemical and manual methods led to a reduction in the quantity of the chemical used and the time spent on labour.

f) Chemical control of O.barthii - annual wild rice

The control of O.longistaminata has been given priority in weed science research programmes. The aim of this trial was to compare the effectiveness of two herbicides (paraquat and glyphosate at different rates). Technoma was used for the herbicidal treatments which were carried out 33 days after the wild rice was sown.

The count taken when the floods had subsided. The points awarded for effectiveness, 8, 20 and 153 days after the treatment, show that only glyphosate at 1.10 kg a.i./ha provided increasing effectiveness. When the flood had subsided all the other plots were covered with O.barthii.

g) Herbicide trials

This trial consists of 15 treatments. Nang Kiew variety were used. The plots on high land suffered much more from drought and damage by Heteronychus oryzae than those in the valleys. The weeds present were: Panicum anabaptistum steud, Melochia corchorifolia L, Aeschynomene sensitiva Aw, Iopmaea aquatica FORSK and especially the wild rice O.barthii on which the herbicides used were not effective. Propanil (STAM F34) at 3.24 kg a.i./ha yielded the same results as weeding by hand.

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5) Entomology

a) Collection and identification of main insect pests of floating rice

During periodic visits to the paddy fields of farmers andplots at the station, besides the insects mentioned in the Annual Research Report, Volume 3, May 1978, the following two other insects were encountered:

Defoliators

Acrididae — Schistocera gregaria

Stinging insects;

Coreidae — Leptocorisa apicalis

b) Fluctuation in population of predominant stemborers

A light trap was used to monitor the fluctuation of population of adult insects. A hurricane lamp was used to attract the adult insects during the night and trap them in a basin of water. The light trap was set up 1 metre above the rice plants. The lamp was left on from sunset to 10 pm and the insects were collected each morning.

c) Timing of insecticide application for insect pest control

The variety tested as Khao Gaew. The insecticides used were Carbofuran 3G at 1.5 kg a.i./ha and Dimecron 250 EC at 2.00 kg a.i./ha. The treatments were started 10 days after rice emergence and were carried outevery 20 days until the floods arrived. After the arrival of the floods only leaf spraying was done until heading time. Carbofuran at the rate of 1.5 kg a.i./ha was the best treatment for the control of leaf-eating caterpillars.

The highest yield of 2.71 t/ha was noted for complete protection. As for the leaf-eating caterpillars, it was found that the rice plant recovered after an attack and this means that chemical control is not necessary at the moment. Granulated Carbofuran was the most effective way of controlling the insects.

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Leaf-spraying is effective after the arrival of the floods.

d) Effect of various granulated insecticides (at the rate of 1.5 kg and 2.00 kg a.i./ha) on rice insects

The variety used was Khao Gaew.

Treatments

Carbofuran 3 g
Dursban 5 g
Oftanol 5 g
Basudin 10g

Control : no insecticide

All the treatments began ten days after emergence and were carried out every 15 days until the arrival of the floods. Damage done by leaf-eating caterpillars and stem borers as well as the yield were recorded. Only Carbofuran appeared to be very effective in controlling damage done by leaf-eating caterpillars. This was also the best, compared with the others, for the control of floating rice insect pests.

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II. IRRIGATED RICE - RICHARD-TOLL/FANAYE (SENEGAL)

Introduction

The WARDA special project began in July 1976 with the first phase terminating at the end of November 1978. The main objective of the project is to solve the irrigated rice agronomic problems in the region and especially in the Sahelian sub-region.

Research activities

All the experiments in 1978 except one trial in Fanaye, were undertaken on the provisional site called CANAL-D at Richard-Toll. The research programmes, particularly those dealing with Physiology and varietal improvement were affected because of the flooding at the Fanaye station. The transfer of the experimental fields from Richard-Toll to Fanaye originally planned to take place between July and August 1978 only occurred at the end of November.

The Weed Science programme was not undertaken because of the absence of the scientist in charge.

1. Physiology

Effects of nitrogen and phosphorus on growth and yield of two rice varieties during the cold season

Two rice varieties were used : IR8 which is susceptible to cold and Fujisaka 5, a cold tolerant variety. There were four nitrogen levels:
70-100-130-160 kg N/ha and five phosphorus levels:
0-60-120-180-240 kg P_2O_5/ha

Phosphorus is beneficial to the growth of rice varieties. It was observed that in the plots which had received doses of 100 to 240 kg of P_2O_5/ha, there was fairly rapid recovery and good plant growth as compared with the control plot. For both varieties, there was a negative relationship between the vegetative period and the rate of application of phosphorus.

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In the absence of phosphorus, the growth period is increased. When the quantity of nitrogen is higher than that of phosphorus, flowering is delayed; the reverse happens when the phosphorus dose is higher than that of nitrogen. The 70 N/160 P_2O_5 or 100 N/180 P_2O_5 combination seems to be adequate in the cold off-season at Richard-Toll conditions. The best yields were noted for IR8 which in fact has a higher yield potential than Fujisaka 5. Varieties react well to application of N ranging between 100 and 160kg/ha.

The height increased with increasing doses of N. In this study, the 100 kg/ha dose seemed to be the most efficient with respect to the translocation of Photo-synthetates in the cold-susceptible IR8.

The yield index of the cold tolerant, Fujisaka 5 behaved differently from IR8. The difference was negligible between treatments. The N/P ratio does not seem to play a major role. However, the rule that the dose of N should be $\frac{1}{2}$ the dose of P_2O_5 still holds.

From this analysis the conclusion can be drawn that in the cold off-season, it is important that the N dose, to be applied to rice be moderate and lower than that of phosphorus in order to speed up growth and avoid an abundance of late tillers.

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2. Variety improvement

Screening of rice varieties for cold tolerance

The aim of this screening exercise was to find out rice varieties tolerant to low temperatures and have a growth duration of 130 to 150 days.

198 entries from the International Rice Cold Tolerance Nursery (IRCTN) were used for this screening exercise. Sowing was carried out on the following three different dates in a completely protected area :

i) In October, in order to study the behaviour of these materials particularly at the flowering stage which in this case would occur when the temperature is fairly low.

ii) In November, to study the effect of cold on vegetative growth at the coldest period, and at the same time to confirm the choice which would have been made at the first sowing date.

iii) In December to confirm the choices made at the 1st and 2nd sowing dates.

The two controls were : IR 8 a susceptible variety and Fujisaka 5 a tolerant variety.

Out of the 198 entries, 66 were selected and divided into three groups according to three important criteria which are:(i) Panicle exertion; (ii) Rate of sterility; (iii) Phenotypic acceptability.

A classification index calculated by adding up the different values obtained for these three criteria of tolerance was used. The lowest figures indicate the highest tolerance of the variety to cold. Thus in the first group we find varieties with index values between 5 and 7 (Table 26).

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Table 26: Varietal Response to Cold and Characteristics of Group I Entries - Richard-Toll, Cold dry Season 1978/79

Introduction	Height (cm)	50% Heading(days)	Maturity (days)	Index
FUJISAKA 5-Tolerant(Control)	75	109	136	9
IR 5867-45-2-3-2	90	122	147	5
IR 3249-19-1	93	124	145	5
IR 5867-50-3-2-1	86	130	150	7
IR 5467-2-2-2	97	122	146	7
IR 5867-45-2-1-2	87	120	147	7
IR 7167-33-2-4	94	119	144	7
IR 7167-33-2-5	94	119	144	7
K - 78 - 13	85	111	147	7
KN-1B-361-BLK-2-5	94	130	152	7
KN-1B-361-2-2-4-1	96	135	154	7
KN-1B-361-8-6-9-2-6	100	126	149	7
KN-1B-361-8-6-9-4-4	98	126	149	7
KN-1B-361-179	95	130	152	7
KN-IB-361-BLK-13-9	89	126	147	7
IR 184-296-3	100	130	152	7
IR 8 susceptible(Control)	56	135	-	-

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The first group includes 15 entries which gave the best results in respect of vegetative growth and sterility. The second group is made up of entries whose index value is between 9 and 11 (Table 27).

Table 27: Varietal Response to Cold and Characteristics of Group II Entries - Richard-Toll, Cold Dry Season 1978/1979

Introduction	Height (cm)	50% Heading (days)	Maturity (days)	Index
FUJISAKA 5-Tolerant control	75	109	136	9
IR 5031-B-JN 1B	103	122	147	9
IR 5865-32-3	86	126	140	9
IR 5868-88-2-3-1	97	120	146	9
IR 5908-40-3-2-2	79	130	154	9
IR 5867-45-2	86	120	147	
LENG KWANG	111	140	-	9
NAENGDO	86	130	150	9
PADI LABOU ULUMBIS(ACC 14378)	109	136	154	9
PARO WHITE	90	130	154	9
RPKN - 2	102	122	143	9
R x T - 42	79	133	154	9
B733C-KN-67-3-2-1-9	86	130	-	11
CR 126-42-1	79	109	132	11
HABIGANJ BORO II	115	115	144	11
HP 46	104	114	143	11
IMOCHI -314	105	114	143	11
IR1846-300-1-1	95	130	155	11
IR 5865-9-3	97	114	139	11
IR 5865-26-1	94	126	145	11
IR 5865-26-1-2	92	122	149	11
IR 5867-50-3	87	120	147	11
IR 5908-26-3	76	130	154	11
IR 7167-4-3-2	97	122	147	11
IR 7167-33-2-3	89	120	147	11

Table 28 contd.

IR 10-22-12	106	122	144	11
IR 5908-84-2-2	72	136	154	11
KN-1B-361-8-6-9-2-2-2	95	130	150	11
KN-1B-361-BLK-14-1	88	130	152	11
PRATAO	89	144	-	11
RP 1153-12-4	89	130	154	11
IR 8 - Sensitive control	56	135	-	-

There are 31 varieties in the second group and if the characteristics for evaluating cold tolerance are taken individually some of the entries in this group stand out from the others. The following varieties behaved best as far as sterility and panicle formation are concerned. IR 7167-4-3-2; IR 7167-33-2-3; KN-1B-361-BLK-14-1; NAENGDO: PADI LABOU ALUEBIS (ACC 14 378).

The third group contains entries whose sterility rate is in the neighbourhood of 20-25% and whose panicle formation is fairly satisfactory. There are 20 entries in this group which have an index value of between 13 and 15.

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3. Entomology

i. Effects of sowing dates on the incidence of Stem borer on some rice varieties:

Eight popular varieties such as IR 8, DJ684D, DJ346D, Taichung Native 1, Chun Aye, I Kong Pao, Kwang She Sung and Jaya were sown at three different dates (11/8/78, 25/8/78, 7/9/78) and transplanted 20 days after sowing.

Although some varieties showed greater borer resistance than others, the sowing date seemed to be a determining factor on the abundance of borers and their damages. For dead hearts varietal resistance is the only factor that determines the amount of damage. On the other hand, white head was associated with the time of planting.

With the exception of Sesamia sp. and Eldana saccharrina, other stem borers such as Maliarpha separatella Rag, Scirpophaga sp. and Chilo sp. appeared from June to mid August when they reached their population peak. Thus early sowing from June to July may cause the most serious stem borer damage. In general, it was noted that delay in sowing resulted in a decrease in the infestation level and in the damage caused by stem borers. Kwang She Shung, Dj684D and Dj346D varieties are very sensitive to borer attacks during the reproductive stage. IR 8 seemed to be resistant to borers during this period. 99% of the caterpillar population was made up of the Chilo type and 1% of Maliarpha separatella Rag.

ii. Effect of Furadan on rice stem borers

The test variety was IR 8. Furadan at the rate of 1.0 Kg a.i/ha was applied every ten days until 20 days before harvest.

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Stem borers (Maliarpha separatella Rag and Chilo sp.) were the most important insects during the trial period. The protected plots (with Furadan) had greater yield (800 kg/ha difference) and weight of 1000 grains, and smaller percentage of borer damaged tillers than the unprotected plots. Completely protected plots had about 2.3% stem borers attack. Trials to assess yield losses will continue for at least three years before a final conclusion can be drawn.

iii. Effect of rates of Diazinon and Furadan on the incidence of insect pests (Stem borers)

IR 8 was used in this study. All the insecticide treatments ensured effective control of borers (Chilo sp. especially). The 0.5 kg a.i. per hectare of Diazinon 10 G dose produced less effective control than the others. There was a positive relationship between the percentage of infested tillers and caterpillars (r = + 0.82) Furadan at the rate of 1.5 kg and 2.0 kg a.i/ha gave the best yields. 13.5% and 16.9% respectively yield increase over control yield of 5.27% t/ha). These two treatments significantly out yielded the control. Trials will be conducted again to confirm the results but it can be said that the 0.5 kg/ha dose of active ingredient seemed to be insufficient for obtaining high yields.

iv. Observations on the insect pest complex of rice in the Senegal River Valley

The most destructive rice insects belong to the borer, defoliator and sucker groups.

a). Rice stem borers

Five species have been found:
Maliarpha separatella Rag, Eldana saccharina, Chilo sp., Scirpophaga sp. (Pyralidae) and Sesamia sp. (noctuidae). Three of them: Maliarpha, Separatella Rag, Chilo sp. and Sesamia sp. are potentially dangerous for rice in the valley.

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Maliarpha separatella Rag

In an epidemic year e.g. in 1977 it destroyed at least 80% rice tillers. Damage is not easy to detect. It neither causes white heads nor dead hearts.

Maliarpha separatella Rag seemed to enter into ecological competition with Chilo sp. In rainy year when Chilo sp. multiplies more, Maliarpha separatella is rarer (1978 hot wet season).

Chilo sp.

This year, the Chilo type was particularly dominant among stemborers. For this reason incidence of white head was especially serious: 50 to 60% (IRAT 10, IRAT 13 and IR 1529-680-3, WARDA Seed Farm). In terms of damage, Chilo is the most important stemborer in the Senegal River Valley.

Sesamia sp.

The most permanent borer found throughout the year. It multiplies rapidly especially during the cold period of the year from December to January. In the absence of any competition with other insects during this period, it developed perfectly well and caused damage especially of the type "dead hearts" - 10 - 25%. It was readily parasitized at the larval stage (90 to 95% mortality) from February to March.

b. Defoliators

Four insects were common:
Mytimna loreyi (Noctuidae), Diacrisia sp., Creatonotus loucanoides (Arctiidae) and Parnara sp (Hesperidae).

Mytimna lorey was by far the most important defoliator. It was also found on sorghum and maize where it caused major defoliations. This insect appeared in great number from September to October.

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Suckers

There were at least 13 species of insect suckers belonging to the Hemiptera family. In this group, the 5 important species are Aleurocubotus sp. indicus, Nephotettix sp, Sogatella sp (homoptera), Easarcoris inconspicuus and Piezodorus punctiventris (entatomidae)

Nephotettix appeared in great numbers particularly on rice during the maturing period from October to November. It was common in all the paddy fields.

Sogatella sp. was especially widespread from July to August. Aleurocybotus sp indicus - the most spectacular development took place during the hot months. It sucked the sap of leaves and as a result of which the leaves withered.

Easarcoris inconspicuus

It appeared during the maturing period of rice from September to October. It sucked the grains at the milk and dough stage. It is common to see at least 15 to 20 adult insects on each panicle.

Piezodorus punctiventris: It was most often found at the foot of the rice plant. It was present throughout the year but was more frequent in September - October.

Natural Enemies: Several predatory insects noted in the River Valley. The most important predators belong to the following groups: bugs, ants, coccinella, dragon flies, agrinnididae, golden-eyed fly, Cococephalus sp., etc.

Pests collected belonged to two major groups: Hymenoptera and Diptera. Diptera are especially larvae pests while hymenoptera are most often found on chrysalides.

Parasitism, which affected 90 to 95% of the Sesamia sp. caterpillars, is in the process of identification. Parasites collected are currently being identified and will be catalogued later.

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4. Soil science

i. Effect of SUC and granulated urea on rice

The variety used was the cold tolerant KH 998. The granulated urea (46% N) and SCU (37.6% N-0-0, 13.8% S at a dissolution rate of 21% in seven days) were used in doses of 0, 70, 130 and 160 kg N/ha. Granulated urea was applied in 3 splites i.e. 50% basal, 25% at the beginning of tillering and 25% at panicle initiation stage. SUC was applied as basal when phosphorus (60 kg P_2O_5/ha as super triple) and potassium (60 kg K20/ha as KCL) were also applied.

Recovery after transplanting was slower with SCU than with granulated urea. With respect to the number of tillers, no difference was observed and it was only from the 23rd day that the effect of SCU at all doses proved to be higher than all the growth stages. There was a linear relationship between the number of tillers and the nitrogen rate ($r = + 0.9932$ for SUC and $r = + 0.9979$ for Urea) and between plant hight and nitrogen rate ($r = + 0.996$ for SUC and $r = + 0.955$ for urea).

The maturity period in the case of SUC was longer than that of Urea. The weight of 1,000 grains and sterility percentage of grains were greater in urea than in SUC. There was a linear relationship between grain yield and nitrogen rates regardless of fertilizer type ($r = + 0.98$ for SUC and $r = + 0.94$ for Urea).

The quantities of NH + - N released by the soil during the entire cropping season after application of SUC were higher than that released by granulated Urea application irrespective of N rates.

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ii. Effect of methods and rates of application of SUC and Urea on yield

The test variety was Jaya. With respect to nitorgen sources, SUC, normal granulated Urea and granulated urea in the form of big granules were used.

The trials had the following treatments:

Doses of N kg/ha		Forms of urea applied	Method of application
1	0	-	-
2	32	granulated urea	½ (basal) ¼ tillering ¼ P.I. in stripe (per two lines)
3	32	granulated urea	
4	32	SCU	broadcast application
5	32	SCU	application localized in the root zone (per four adjacent plants)
6	32	supergranule	" " " " "
7	65	granulated urea	½ - ¼ - ¼
8	65	" "	stripe
9	65	SCU	broadcast
10	65	SCU	localized
11	65	super granule	localized
12	130	granulated urea	½ - ¼ - ¼
13	130	granulated urea	strip contour
14	130	SCU	broadcast
15	130	SCU	localized
16	130	super granule	localized

The highest yield of 6.09 t/ha was noted for 130 kg N/ha in the form of SUC broadcast, followed by 6.01 t/ha for 65 kg N/ha in three split applications (½ basal - ¼ each at tillering and panicle initiation) of granulated urea and 5.95 t/ha for 65 kg N/ha of SUC broadcast. The control treatment (ON) gave 3.2 t/ha yield. The straw yield increased with the increased rate of nitrogen application and the hightest yield was noted for 130 kg N/ha.

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There was a linear relationship between grain yield and nitrogen rate. The regression coefficients for Jaya are given below:

(a) SUC broadcast
b = 20.86

(b) Split application of granulated urea
b = 14.39

(c) Localised application of SUC
b = 12.58

(d) Granulated Urea in border stripe
b = 5.63

(e) Localised application of super granule
b = 4.83

At all levels of N, localized or stripe application gave lower yields. It would be premature to draw a conclusion from this trial but it seemed that the duration of varieties play an important role. In the case of SUC rate of release of 21% in 7 days is more profitable to short duration varieties such as KH-998 than long duration varieties like Jaya. It may be worth noting that even though SCU stimulates greater release of NH +-N in the soil, it favours plant-growth more (with the exception of higher rates) and does not seem to be superior to the present granulated urea in terms of paddy yield.

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III. MANGROVE SWAMP - ROKUPR, SIERRA LEONE

Introduction

During the 1978 season all desciplines carried out a full programme of work. The details of the work will be available in Volume III of the 1978 Annual Research Report. Here only the highlights of the activities have been presented.

Research activities

1. Variety improvement

Late in the season 261 lines from IRLRON and 176 lines collected from acid sulphate areas by IRRI were received. They were planted late to maintain the seed and do a preliminary screening.

Seventy-six selections made in 1977 were further evaluated under associated swamp conditions and nine were chosen for further work.

Twenty-two selections from the 1976 IRSATON made in 1977 were grown in an observation and yield trial. The three lines selected as being promising as parents in a hybridization programme are DA 29, Pokkali and IR 2153-43-1-5-4.

In 1978 season, three hundred and sixty-six introductions from Sierra Leone, thirty-five from Gambia, nineteen from Guinea Bissau and thirty-four from Nigeria were all grown in an observation trial.

168 of these were purified and characterised. 272 panicles were also selected for characterisation in the next season.

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Early generation lines received from the national programme in 1977 were grown as F5 material in 1978 and 158 single plant selections and bulks were made.

Twenty seven new crosses involving one locally collected or bred cultivars and an introduced parent were made. The progeny have been successfully grown in buckets during the dry season.

Six long duration varieties were tested on nine farmers' fields under simulated farmer conditions. Five of the varieties CP 4, RH 2, BL 4-E, Nachin 11 and AA8A performed equally well at the nine locations. One variety L78-9148 was significantly poorer.

Three replicated yield trials were conducted, two using medium duration varieties and one long duration variety. The varieties were tested with and without 50 kg N per ha as Urea applied by the injection method. In the two trials, one long and one medium duration variety trials at Rokupr the main feature was the lodging of most varieties caused by excess nitrogen. None of the new varieties performed better than the current recommended lines.

At Mapotolon, saline area and associated swamps, it was shown that ROK 5 and BD 2 out-yielded the local variety Pa Nylon by 100 percent with or without nitrogen. Larger scale and more extensive testing in these areas will be done in 1979.

2. Pathology:

A detailed picture is being developed for the incidence and severity of a wide range of diseases of rice in the mangrove and associated swamps. This guides the pathologist in the monitoring of breeder's materials, and where detailed basic studies should be directed.

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The work done in the 1978 season is summarized below:

Seedling blast (Pyricularia oryzae) was a major nurseries. Brown spot (Helminthosporium oryzae) as incidental but tended to assume greater importance in older nurseries.

A generalized scale was adapted and defined for the use of recording diseases. The following fungal diseases were recorded in the mangrove and its associated swamp ecology; blast (Pyricularia oryzae), brown spot (Helminthosporium oryzae), leaf scaled (Rhynchosporium oryzae), narrow brown leaf spot (Cerospora oryzae), leaf smut (Entyloma oryzae), sheath blotch (Pyrenochaeta oryzae), sheath blight (Corticium sasakii), sheath rot (Acrocylindrium oryzae), false smut (Ustilagenoidea virens), dirty panicles H. oryzae, Leptosphaeria sp., Phoma sorghina and Diplodiella oryzae and the panicle sugary disease, cattail fungus or Udbatta (Ephelis pallida).

Crop loss assessment study on Udbatta in farmers fields in the mangrove and the associated swamps in Sierra Leone gave a maximum yield loss of 4.6 per cent for the season.

Disease monitoring of 1,500 varieties grown by the breeders established brown spot, leaf scald and narrow brown leaf spot as the major foliar diseases in the Rokupr swamp. A similar picture was obtained in the disease surveys on farmers fields. Udbatta, though erratic in behaviour was nonetheless recorded extensively in the ecology.

Aphelencoides besseyi Christie, the rice "white tip" nematode was recovered from malformed panicles on the variety ROK 4 obtained from the Rokupr mangrove swamp. Typical "White Tip" symptoms were also obtained on the varieties Zenith in the Mawirr associated mangrove swamp of Rokupr and Pa Nylon, ROK 5, IR 20, IR 5, C13F1, ROK 4, C13H3 and D52-37 in the Kibanka associated swamps near Mapotolong. No parasitic nematode was recovered from the diseased tissues of Zenith, however.

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Screening for horizontal resistance to the rice blast disease was begun in the dry season of 1977/78. Some 30 varieties showing promising resistance were identified.

The presence of a wide spectrum of virulent blast races at Rokupr was confirmed using Japanese blast differential varieties.

Preliminary studies on the biology of the Udbatta organism were initiated. The results suggest that the disease is seed borne and systemic.

3. Entomology

Surveys of farmer's fields combined with light trap studies at Rokupr have shown that Maliarpha separatella is the commonest borer in mangrove rice but in the Mapotolon area it is accompanied by Chilo spp. and around Rotifunk by Sessamia spp.

Small numbers of a previously unrecorded virus vector Sogatodes cubanus were found during 1978.

To determine the economic importance of Aspavia armigera and Stenocoris southwoodi, different numbers of adult bugs of each species were placed in 1 x 1 x 1.6 metre field cages on ROK 5 and CP4 from flowering to harvest. The cages were checked daily and the different bug densities were maintained until harvest. The symptom of damage caused by the two species appeared to be the same. The bugs attacked all stages of grain development from the newly emerged panicle to the dough stage. The attack predisposes the grains to fungus infestation which leads to partial or full browning of the grains. Late infested grains can only be detected after the glumes are removed.

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The per centage of grain damaged increased as the rice bug density increased, which may mean that the amount of "dirty panicle" is a feflection of bug damage. In this preliminary study, grain weight andper centage grain damage are related by the following regression equations:

Aspavia on ROK 5: $Y = 10.15 - 0.12 X$ ($r = -0.98^{**}$ $n = 8$)
Aspavia on CP 4: $Y = 9.91 - 0.11 X$ ($r = -099^{**}$ $n = 16$)
Stenocoris on ROK 5: $Y = 9.2 - 0.15 X$ ($r = -0.90^{**}$ $n = 8$)
Where Y is weight of 500 grains and X is percent grain damage.

The results indicate that yield loss can be expected at certain population density. Further studies will be pursued to estimate the economic value of the bug damage.

Assessment of crop lossess caused by Maliarpha at ten sites on farmer's fields confirmed last year's results of a wide range in losses. In an attempt to eliminate extraneous factors, thought to interfere with this study, trials with a standard variety under uniform cultural practices will be done next year.

It has been shown that Maliarpha lays eggs only inside the young unfolded leaf of rice. This information, not previously recorded, is very useful in interpretating infestation rates and levels of this pest. The physical size, wing span of Maliarpha varies sufficiently through the year for its possible use in population studies of the insect.

It has been demonstrated that virgin females of Maliarpha produces a sex pheremone. Cooperative studies of this Pheremone in cooperation with Tropical Products Institute (TPI) in London have been initiated.

Insect population studies and knowledge of oviposition habits of Maliarpha can explain the facts that early sown crops are less infested than late sown and that long duration varieties suffer more than medium duration lines.

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A large number of parasites of Maliarpha and other important rice pests have been found and many have been identified. In addition, 29 predators of insects have been collected from the rice fields.

The work on the monitoring of pests in all the breeder's material is gradually building up a picture of the range of infestation found locally. A start has been made on relating plant characteristics and pest infestation.

The search for a practical method of applying insecticides has shown that the combination of one nursery application and on broadcast in the field of systemic insecticides to be promising.

Crab control by the soaking of seedlings in chemicals was tested on farmer's fields. The effect were of too soon to be fully effective. Damage levels of up to 80 percent was recorded on young seddlings along the river.

In bucket experiments it was confirmed that delaying the transplanting of seedlings up to 60 days after sowing, a farmer's practice, drastically reduces crab damage. Fertilizers applied in the nursery increases the size and vigour of seedlings and reduces crab damage at all seedling ages.

4. Weed Science:

In the tidal affected areas and pure mangrove swamp, kire kire (Paspalum vaginatum) dominate the weed problem. The results of trials testing cultural and chemical methods of control in 1978 confirm earlier findings that good land preparation and puddling suppressess the weed for the life of the current crop. In soft associated tidal swamps where the weed grows vigorously there are indications that late, (June - July) land preparation is best.

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Farmers associate kire kire with difficult land preparation and with high fertility. Future work will be directed to easing the problem of cultivation, using a single axle tractor, and determining the role if any of the weed in maintaining soil fertility.

In the associated swamps adjoining the pure mangrove, a wide range of weeds species exists. These are a major problem to farmers both at the time for cultivation and during the growth of the rice crop.

The results of a trial carried in the 1977 and 1978 season are presented in Table 28. The data show that substantial yield increases result from handweeding twice (82.1% yield increase and the us of stam F34T (98.9% yield increase) under the farmer's traditional system and cultivation i.e. mannual digging and puddling.

Talbe 28: Effect of various methods of weed control on grain yield under associated swamps (mean of 1977 and 1978 data)

Cultivation methods	No Weeding	Hand Weeding twice		Stam F 34T	
	Yield kg/ha	Yield kg/ha	Yield Incrs. (%) Over no weeding	Yield kg/ha	Yield incrs.(%) over no weeding
Mannual digging and puddling	1510	2750	82.1 (1240kg/ha)	3004	98.9 (1494kg/ha)
Mechanical digging + puddling	2780	3540	27.3 (760kg/ha)	3608	29.8 (828kg/ha)

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Even greater yields were obtained from mechanical digging and puddling (84% yield increase over control yield of 1510 kg/ha) or in combination with handweeding or herbicide application. Other potentially useful herbicides have also been identified in 1978.

Furture work in this ecology will concentrate on the evaluation of these successful treatments as practical methods that farmers can use. At the same time long term trials are to be started to study the effect of these treatments on the weed spectrum with special attention to the possibility of deveLoping treatment resistant species.

5. Soil Science/Agronomy

The main thrust of the work in Soil Science continues to be the development of a practical and profitable method for the application of nitrogen to mangrove swamp rice.

Comparison of forms of nitorgen has shown little difference between them whereas the method of application is critical. Deep placement is preferable to broadcast.

On farmers' fields the technique of deep placing of aqueous solution of urea using an injector device with and without weeding was tested. On others these treatments were compared with sulphur coated urea broadcast also with and without weeding.. The results for 1978 together with those for 1976 are summarized in the Table 29.

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Table 29: Yield response to Urea injected and SUC under farmers' fields conditions in 1976, 1977 and 1978.

	Yield (kg/ha)				
	Year	No. Sites	Control	Urea Inj.	S C U
	1976	10	1,768	2,723	-
	1977	33	2,067	2,747	2,637
	1978	24	2,130	2,728	2,898 (9)
		67	2,045	2,737	2,693
Effect of fertilizer				+ 692	+ 648
Value in Dollars				138.40	129.60
Cost of input*				34.00	38.00
Average profit				104.40	91.60
Cost benefit ratio				3.07	2.41

* Urea is subsidised in Sierra Leone, a bag of 50 kg costs $9.00 SCU is not available and costs have been estimated at $1.80 per bag.
SCU = Sulphur Coated Urea.

It must be stressed that all 67 sites report were farmers' fields, growing the farmers own variety under the farmers own management. The only input was the application of fertilizers. The overall picture that emerges after three years is of a large response to the application of either form of nitrogen giving the farmer a handsome return on his investment in fertilizer. A point of general interest that emerges is that the average farmer on the 67 sites produces over two tons of rice per hectare using the traditional practices. Assuming the average farm size to be one hectare this gives an average gross income of about $400.00 per annum.

The practical weeding comparison included in some of the 1978 trials was disappointing. There was no consistent effect on yield levels. Unlike the results reported in 1977 where all weeds were removed regardless of the cost, this practical test of 8 to 10 man days per hectare indicates that few if any farmers would benefit from doing even one weeding on mangrove swamp.

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Unfortunately the details of fertilizer responses differ markedly from the average results. Some individual farms show cost benefit ratios of over ten whereas others of about ten percent of the farms, no profit or even a loss of money would results from applying fertilizers. These losses were found in very fertile areas where 60 kg N per ha result in severe lodging of the crop. It is thought that lower rates of nitrogen would benefit these farms.

In other cases on sandier soils near the upland or nearer the sea control yields were low and it is thought that nutrients other than nitrogen are deficient. Special investigation of these will be initiated in 1979.

A trial was carried out to the study the effects of depths (10 and 30 cm below the soil surface) of nitrogen application by injection method at different growth stages (40 kg N/ha at transplanting, early tillering or late tillering) on grain yields at river edge, deep flooded and tidal limit sites. The results showed that nitrogen increased grain yield significantly over control at all sites. However, yield differences for differnet depths of nitrogen application and for different times of application were not significant. Without nitrogen the yields at river edge, deep flooded and tidal limit sites were 2451, 1657 and 2401 kg/ha respectively, while yields with nitrogen at the above three sites were 3041, 2532 and 2611 kg/ha respectively.

Fertilizer application in the nursery and rice field

Four and eight weeks old seedlings with (complete fertilizer 15:15:15 at the rate of 0.025 kg/sqm. at sowing followed by another application two weeks later) or without fertilizer in the nursery were grown with and without application of 80 kg N/ha as urea after transplanting.

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The grain yield data show that without nitrogen after transplanting, the fertilized seedlings performed better than the unfertilized seedlings. However, the effect of fertilizing the nursery appeared to be the significant in the case of the four weeks old seedlings only. Application of nitrogen after transplanting produced significant yield increase for all categories of seedlings and appears to have compensated for any difference between fertilized and unfertilized seedlings. Where nursery sites have lost its inherent soil fertility, fertilization would become essential particularly for farmers with whom application of nitrogen after transplanting may not be feasible. There appears to be no advantage in transplanting young seedlings. The indications from the work on entomology are that older seedlings are able to withstand the damage by crops better than younger seedlings.

Yield response to phosphorus and potassium

At Rokupr responses to phosphorus have been low and inconsistent and those to potassium non-existent. The absence of a response to potassium was again confirmed in trials this season, but there was an indication that phosphorus placed deep in the soil and combined with nitrogen increased yields significantly.

Monitoring of salt in soil and water

The monitoring of salt levels in soil and water along the length of the Great Scarcies continued throughout 1978. The results were very similar to those presented in the Research Report for 1977.

Flooding depth in mangrove swamp

The monitoring of the maximum depth of flooding by tide water continued through 1978. During the growing season depth of flooding was generally higher in 1978 than in 1977. The rapid fall in flood depth in mid December, Noted in 1977, was recorded again in 1978.

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IV. UPLAND RICE - BOUAKE, IVORY COAST

Introduction

The main objective is to develop upland rice varieties that are adaptable to this ecology.

Research activities

(a) Evaluation of new lines

Six new short duration lines were evaluated at five sites in Ivory Coast. These locations were both in the forest and at the border line of forest and Savannah zones. IRAT 10 and Durado Precoco were the two checks used. Table 30 below shows the average grain yields (t/ha) of the entries in each of the locations.

Table 30: Average grain yield of six new lines and two checks (t/ha).

	LOCATIONS					
	DALOA	DAOUKRO	TOUBA	TOMBOKRO	MAN	AVERAGE
IRAT 109	2.1	2.7	4.6	2.3	3.2	2.9
IRAT 110	1.5	2.4	3.9	2.8	3.2	2.7
IRAT 112	1.9	1.7	3.8	-	3.2	2.6
IRAT 133	0.8	2.3	3.5	3.0	3.3	2.6
IRAT 134	2.0	3.3	4.1	3.5	-	3.2
IRAT 142	1.5	2.3	4.8	-	-	2.8
IRAT 10 (Control)	1.5	2.3	4.0	1.9	3.9	2.7
Dourado Precoco(control)	1.5	1.2	2.6	-	-	1.8
AVERAGE	1.6	2.275	3.84	2.7	3.16	

The three top yielding entries were IRAT 134 (3.2 t/ha) IRAT 109 (2.9 t/ha) and IRAT 142 (2.8 t/ha).

Although IRAT 134 gave the highest overall yields, it has the following defects: high number of open lemmas (30%), lodging susceptibility and a fairly long growth duration. It is ten day longer than Dourado Precocoe.

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IRAT 109 has consistently given a yield higher than that of the control. Its rate of open lemmas is very low (about 4%) but has the following defects:

- slightly high shattering rate (similar to that of Iguape cateto) grain length/width ratio of 2.3.
- slightly susceptible to neck blast.

(b) Medium and late duration lines:

Ten lines were tried at seven locations in Ivory Coast. The objectives are (1) to find a medium duration line that is at least equal to IRAT 13 and Iguape Cateto in yield but that lacks the defects of being too shattering and that of poor milling recovery. (2) to find a late maturing line with high yield stability, good grain quality, non-shattering and shorter plant height.

IRAT 13, Iguape Cateto and Moroberekan were the checks in the trial. None of the new lines showed much higher yielding ability than the controls. However, IRAT 105, IRAT 132, IRAT 136 and IRAT 138 gave slightly higher yields than the controls. These lines also possess some more desirable triats than the controls. They will be included in WARDA 1979 IETs and other trials in the region.

(c) Study of the initial vigor

The initial vigour is a characteristic which is important when the growing conditions are not good either because of agroclimatic conditions or because of cultural practices. Rapid vegetative growth will make the plant's roots grow deeper (thus making the plant more resistant to drought when there is no rain) and to grow faster than weeds. But this rapid growth must slow down at a tillering and flowering otherwise the plant becomes too tall and can lodge or have too many hills with exuberant tillers and excessive vegetative growth at the expense of developing its reproductive organs.

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The O. glaberrima rice varieties that are studied in details at Bouake are thought to have these desirable characteristics. It was also considered useful to compare the different categories of rainfed rice varieties of O. glaberrima traditional, O. sativa and short O. sativa.

22 varieties were studied using 5 replications. At three weeks after seeding, observations were made on 10 plants for weight and on 50 for height, in each replication. OGIOA, a glaberrima variety was the most outstanding in the trial considering the fresh and dry matter weight and height at three weeks after planting.

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WARDA's COLLABORATIVE WORK WITH OTHER INSTITUTIONS

During the year in review many new agreements were signed and the former collaborative activities were strengthened. A brief highlights of the collaborating institutions and programmes are hereby presented.

1. International Institute of Tropical Agriculture (IITA)

For the purpose of promoting greater professional collaboration between IITA and WARDA, the two parties reached a mutual agreement in which an IITA Senior Rice Breeder was seconded to WARDA for an initial period of two years with an option for extension by mutual agreement.

2. International Rice Research Institute (IRRI)

To further strengthen the linkage between WARDA and IRRI late in 1978 a decision was made to post an IRRI Liason Officer to Africa based in IITA but with major committments to the West Africa Region for the first two years.

3. Bangledesh Rice Research Institute (BRRI)

In promoting and accelerating the progress of rice research, training and development agreement has been reached with BRRI for exchange of scientists (a Senior Rice Breeder has been made available to WARDA by BRRI) and exchange of germ plasm and Breeding materials.

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4. International Fertilizer Development Center (IFDC)

Both WARDA and IFDC have agreed on a cooperative programme of research on rice fertilizers as they relate to crop production.

5. Catholic University - Louvain, Belgium (UCL)

The agreement between ULC and WARDA is to study the use of Azolla and Blue green algae as a source of Nitrogen for rice production.

6. Indian Council of Agricultural Research (ICAR)

Agreement has been reached between WARDA and ICAR to exchange Scientists and Technologists (WARDA Senior Pathologist was made available by ICAR) and exchange of germ plasm and Breeding materials.

7. Sahelian Institute

WARDA and Sahelian Institute have agreed to cooperate in the implementation of a programme to facilitate rice production in the Sahelian zone.

8. Assistance to the Ministry of Agriculture, Liberia

Agreement has been reached between WARDA and the Ministry of Agriculture for WARDA to assist in the technical supervison of the rice research programme of the Ministry.

9. Project on Management of Bird and Rodent Pests in West Africa.

In cooperation with national and international centers in the region WARDA will undertake various studies on birds and rodents destructive to rice in the field and in storage.

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Testing of the available methods of control and the dissemination of the practicable package of practices to extension workers and farmers will be undertaken.

CONFERENCES AND MEETINGS

1) ANNUAL RESEARCH REVIEW

The review took place in Monrovia, WARDA Headquarters from 22 to 26 May. This was meant to study the rice research findings in the region including the work of both WARDA staff and research staff of National programme of Member Countries. Observers from member states and other Rice Research Institutes outside the region were also present. On the whole, there were 108 participants from the Organization and its member countries, 12 from the Cooperating Agencies, and 13 observers from such similar institutions.

2) IN-HOUSE REVIEW - RICHARD-TOLL, SENEGAL

This review was held from July 24th to 27th and it was meant to study and critically discuss research activities of the WARDA professional staff. It included no activities outside WARDA and its special projects, and was purely technical, with regards to work at Headquarters (the Seed Laboratory and Seed Nursery farm at Suakoko), The Special Projects, the Seed multiplication at Richard-Toll, and Research Coordination in the 5 Sub-Regional Zones. In this review 24 of the professional staff participated.

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3) RICE WORKSHOP IN NIGERIA

This was the second of such workshops organized by WARDA. The first one was held in Sierra Leone in 1977. The focus, during this workshop, was on the long term strategy for the transfer of technology in rice production throughout the West Africa region. The important role WARDA has to play in this regard was well emphasised by Dr. Atanda the Director of National Cereals Research Institute, Ibadan, Nigeria. Participants included delegates from some WARDA member countries and WARDA staff, totalling to 55 in all were present at the Workshop.

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4) TAC REVIEW TEAM

This team, appointed by CG, came in September 1978 to evaluate the work of WARDA and the justification for its establishment in 1970. The panel really focused its attention mainly on those financed by CG for the past five years. It also had the opportunity to have general overview of all WARDA programmes and comment on them.

5) USAID REVIEW

At the request of USAID, an evaluation team was appointed to study the activities of WARDA, primarily concerning itself with those activities of the Association which receive financial assistance from USAID. Four individuals formed the team, and the main motive was to find a justification for solliciting more financial support from USAID. The two stations (Special Projects) funded by USAID through the Research Department are: Rokupr and Mopti. Other funded areas come under the Training and Development Departments.

6) INTERNATIONAL CONFERENCES, MEETINGS AND VISITS - 1978

a) Dr. Harry Will - Research Coordinator (till December 1978)

i. March 10 - Visited IITA and the Ogun-Oshun River Basin Development Authority Headquarters, Nigeria.

ii. Oct. 10 - Visited the Catholic University of Louvain Belgium, (for consultations with staff on the cooperate work on Blast and Azolla).

iii. Oct. 11 - Visited Overseas Pest Research Centre. Discussions for Intervention of ODM, through Overseas Pest Control Unit, in problems of grain eating birds of West Africa.

iv. Nov. 16 - Visited IFDC and TVA. Discussions on cooperative agreement between WARDA, IFDC and TVA on the application of the new fertilizer technology on rice in West Africa.

v. Nov. 30 - Dec. 1 - Meeting of the IBPGR Rice Advisory Committee at USDA, Maryland, USA. Rice Germ plasm collection programmes of Institute as well as National programmes.

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b) Dr. B.A.C. Enyi: Research Coordinator (From Dec.1978)

i. April 1978 - Participated in All India Rice Research Workshop held at the Punjab Agricultural University.

ii. Dec. 1978 - Represented WARDA at the CGIAR Meeting held in Washington D.C. U.S.A.

3). Dr. Das Gupta: Variety Improvement Coordinator

April 14-21 - Attended International Rice Conference at IRRI.

April 22-28 - Visited BRRI, Bangladesh and ICAR, New Delhi, India.

4). Dr. D. Srivastava: Senior Pathologist

August 16-23 - Represented WARDA in the 3rd International Congress of Plant Pathology in Munich.

Paper presented "Need to review the status of Plant Pathology in developing countries".

5). Dr. M. Agyem-Sampong: Entomologist - Rokupr Project.

December 5-8 - Represented WARDA at the Inauguration of African Association of Insect Scientists at ICIPE, Nairobi, Kenya.

Paper presented: "The Ecology of Rice Stemborers in West Africa".

6). Dr. R.B. Kagbo - Sub-Regional Coordinator - Gambia.

April 1978 - Participated in the All India Rice Research Workshop held at the Punjab Agricultural University.

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PROFESSIONAL STAFF LIST

B.A.C. ENYI, M.Sc., Ph.D., F.L.S., F.R.S.A., F.I. Biol., F.I.B.A.	-	Research Coordinator
G.A. PAKU, M.Sc. Ph.D.	-	Agronomic Statistician
M.A. CHOUDHURY, M.Sc. Ph.D.	-	Senior Rice Breeder
A.O. ABIFARIN, M.S., Ph.D.	-	Senior Rice Breeder - IITA/WARDA
D.N. SRIVASTAVA, A.I.A.R.I., M.Sc. Ph.D.	-	Senior Plant Pathologist
N.S. BANGURA, M.S.	-	Assoc. Plant Pathologist
B.A. LARINDE, M.S.	-	Seed Technologist
L. KANDAKAI (Mrs.), B.Sc.	-	Asst. Seed Technologist
G. VARANGO, B.Sc., D.P.L.G.(Town Planning)	-	Architect
O. KOFFI, Ing. Pedologue	-	Sub-Regional Coordinator - (Zone 5)
S. ASSEGNINOU, Ing. Agronome, D.E.A.	-	Sub-Regional Coordinator - (Zone 3)
R.B. KAGBO, M.S., Ph.D.	-	Sub-Regional Coordinator - (Zone 1)
D.K. Das GUPTA, M.Sc., Ph.D.	-	Sub-Regional Coordinator - (Zone 4)
D.C. PANKANI, M.Sc.	-	Asst. Sub-Regional Coordinator (Zone 4)

SPECIAL RESEARCH PROJECTS

ROKUPR - SIERRA LEONE

E. JONES, M.Sc.	-	Soil Scientist and Head
J. STENHOUSE, M.Sc.	-	Breeder
M. AGYEN-SAMPONG, Ph.D.	-	Entomologist
M. JONES, B.Sc.	-	Research Asst/Breeding (on Study Leave)
H.M. BERNARD, B.Sc.	-	Research Asst. Weed Science
C.A. DIXON, B.Sc.	-	Res. Asst. Soil Science
S.N. FOMBA, B.Sc.	-	Res. Asst. Plant Pathologist
S.J. FANNAH, B.Sc.	-	Res. Asst. Entomology

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RICHARD-TOLL/FANAYE - SENEGAL

H. VAN BRANDT,	M.Sc.	- Soil Scientist and Head
A. COLLY,	Ing. Agronome	- Research Asst. - Breeding
T. DIOP,	B.A.C. (Agricole)	- Research Asst. - Entomology
I. CAMARA,	B.S.P.	- Research Asst. - Soil Science
A.M. DIOP,	Ing. Agronome	- Research Asst. - Weed Science
J. DOME,	Ing. Agronome	- Assistant Breeder

MOPTI, MALI

M. GOITA,	Ing. Agronome, M.Sc.	- Research Asst. - Breeding, Acting Director
S. KOLI,	M.Sc., Ph.D.	- Agronomist, Deputy Director
A. DIARRA,	M.Sc.	- Research Asst. Weed Science
A. TOURE,	Ing. Agronome	- Research Asst. Agronomy
C. DEMBELE,	Ing. Des Science	- Research Asst. Entomology
M. DEMBELE,	Ing Agronome Science	- Research/Extension Officer

BOUAKE, IVORY COAST

J. DALLARD,	D.E.A.	- Agronomist

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