REGIONAL APPROACH TO SORGHUM IMPROVEMENT IN WEST AND CENTRAL AFRICA[1]

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1. Paper presented at the SAFGRAD Inter-Network Conference, Niamey, Niger, 7-15 March, 1991.

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ABSTRACT

In attempts to meet its objectives, the West and Central Africa Sorghum Research Network (WCASRN), which has 17 member countries, places emphasis on seven major activities. These are regional trials, research projects, training, monitoring tours, workshops, steering committee meetings, and visits to National Agricultural Research Systems (NARS). These activities contribute to the overall objectives of strengthening sorghum programs in the NARS. However, two important objectives of WCASRN are to develop improved varieties and hybrids and to contribute to the research needs of the NARS. Since 1986, the Network has organized regional trials and nurseries with the participation of scientists from NARS. Through these trials, early and medium maturing genotypes such as ICSV 1083 BF, CE 180-33, and ICSV 111 IN and ICSV 1063 BF, ICSV 1029 BF, and Malisor 84-1, respectively, and hybrids such as ICSH 232, ICSH 336, and ICSH 507, have been identified. Promising lines for tolerance to *Striga* and resistance to the three major sorghum leaf diseases in the region have also been identified. Some of

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37-11

these genotypes will be evaluated more intensively by certain NARS in multilocational testing. Five research projects were initiated in 1989. In Burkina Faso, Niger, and Mali, project scientists are working on identifying resistance to leaf anthracnose, long smut, and head bugs, respectively. Studies on some aspects of the epidemiology and population dynamics of the causal agents of these three biotic stresses are also underway. In Nigeria, the project scientists have identified a suitable local sorghum variety (Farafara) for use in wheat/sorghum composite flour. The project in Cameroon will provide sorghum genotypes with good resistance to *Striga* for further testing in the region. Thus, over the years, WCASRN has made some modest impact with respect to improved varieties, some of which are in advanced stages of testing in some NARS. The five research projects have created further incentive to scientists in NARS to engage in research. Working group meetings on these projects enable experts from NARS to discuss results and future work plans. Scientists in NARS are thus interacting to solve common problems.

INTRODUCTION

General

There appears to be a concensus on the inability of many countries in sub-Saharan Africa to grow sufficient food to feed their rapidly increasing human population (Youdeowei, 1987). Irrespective of the complexity of the factors which are responsible for this situation, long-run human capability, scientific and institutional, and social organizational issues -the prime movers of agricultural development- have been seriously neglected by both African policy makers and

donors (Eicher, 1988). The semi-arid tropics are usually defined by using climatic parameters. Areas where precipitation exceeds potential evapotranspiration for between 2 to 7 months annually are conventionally classified as semi-arid. In West Africa, this corresponds to mean annual rainfall limits of between approximately 250 and 1300 mm (Matlon, 1983). Youdeowei (1987) is of the opinion that although biological, social, economic, and ill-defined agricultural policy issues contributed to the food production crisis in Africa, drought-stress, poor soils and lack of efficient soil-water management techniques were most severe contraints to food production in semi-arid Africa.

Sorghum (*Sorghum bicolor* (L) Moench) is grown widely in many countries in semi-arid West Africa. In several of these countries, sorghum could be regarded as the staple food. Most of the sorghum is grown in the Sudanian Zone (500-1000 mm annual rainfall) and the Northern Guinean Zone (1000-1200 mm annual rainfall). Some sorghum is also grown in the Southern Sahelian Zone (400-500 mm annual rainfall). Along with pearl millet (*Pennisetum glaucum* (L.) R.Br.), it provides the main energy source for the people of the Sudanian and Northern Guinean Zones (Curtis, 1965). There is a considerable variation in the type of sorghum grown in West Africa by farmers. These local varieties are low yielding, adapted to low fertility, and generally not responsive to high levels of fertilizer (Zummo, 1984). Average grain yields under traditional management vary from 800 kg ha^{-1} in the Sudanian Zone to 400 kg ha^{-1} in the Sahelian Zone (Stoop et al, 1982). Yields can also reach 1500 kg ha^{-1} in the Northern Guinean Zone (Matlon, 1983). Cereals, particularly sorghum and millet occupy nearly 70% of the total cultivated area in Semi-Arid Tropics in West Africa (Matlon, 1983). Thus, sorghum is important in semi-arid West Africa for which its improvement, through research

and extension and through training of personnel in National Agricultural Research Systems (NARS) is vital. Regional research networks could be instruments through which these goals could be achieved.

The West and Central Africa Sorghum Research Network (WCASRN) - Background and Objectives

Phase II of WCASRN started in September 1, 1986 and will end in August 31, 1991. The United States Agency for International Development (USAID), through the Semi-Arid Food Grain Research and Development (SAFGRAD) a component of the Scientific Technical and Research Comission (STRC) of the Organization of African Unity (OAU), provided a grant of 1.7 million dollars for phase II of WCASRN. This grant was sub-contracted to the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) whose West African Sorghum Improvement Program in Mali (WASIP-Mali) executes the project, with the provision of a Coordinator. The execution of the project by ICRISAT was carried out from Ouagadougou up to June 1988 when the Sorghum Program was re-organized and moved to Bamako as WASIP-Mali. Before phase II was formally launched, a regional sorghum workshop sponsored by ICRISAT/SAFGRAD/USAID was held in Ouagadougou, Burkina Faso from 27-30 November, 1984. During that workshop, representatives from NARS agreed that ICRISAT should coordinate the activities of a sorghum network. It was attended by a total of 46 participants from 16 countries. The idea of a regional approach to sorghum improvement was discussed and approved. The West Africa Sorghum Research Network became operational in 1985 when a Steering Committee was formed. The Committee consisted of representatives from NARS as members and representatives from several regional organizations as observers.

The purpose of the USAID grant was to address the sorghum improvement problems of West Africa by concentrating on problems and constraints having regional significance, and by establishing the necessary links with national, regional and international institutes to serve the entire region effectively. The objectives of the Network are:

a) To increase the production of sorghum thereby contributing to the stabilization of food supplies in the region and contributing to improved nutrition and income for farmers in the drier areas of the region;

b) To assist and strengthen national sorghum improvement programs, and contribute to their research needs in all agroecological semi-arid zones;

c) To develop improved varieties and hybrids and agronomic/management practices capable of giving higher and more stable economic yields in the semi-arid environments;

d) To organize and promote systematic regional testing of available and improved genetic material and technology in the semi-arid zone;

e) To facilitate the development of agricultural research manpower among West Africa nationals at all levels; and

f) To organize regional workshops and monitor uniform yield trials through field inspections.

1 Scope of the Paper

2 This report will cover six areas related to the activities of WCASRN. The
3 Network's program and implementation strategy will be briefly discussed in the
4 first section. Summaries of the approaches adopted and results obtained from the
5 regional trials between 1986 and 1989, and from the five research projects will
6 be presented in the second and third sections, respectively. An attempt will be
7 made to synthesize progress made from the regional trials and research projects
8 in section four. The two last sections will cover the anticipated future thrusts
9 of WCASRN and concluding statements, respectively.

10 WCASRN PROGRAM AND IMPLEMENTATION STRATEGY

11 The main activities of the Network are as follows:

12 - Training
13 - Regional trials and nurseries
14 - Research projects
15 - Monitoring tours
16 - Regional workshops
17 - Visits to NARS.

18 The Network places a lot of emphasis on the regional trials and nurseries.
19 Hence, WCASRN can be described as a "trials" Network. However, since 1989 funds
20 were made available for the implementation of five research projects.

Administrative and technical support are given by ICRISAT in Mali, except for hybrid production which is carried out by ICRISAT in Nigeria. ICRISAT provides a Coordinator who is the Pathologist in the ICRISAT-Mali team. The Coordinator implements the decision of the Steering Committee which meets on the average twice a year, and is the driving force behind the Network. The Coordinator carries out the day-to-day activities of the Network by making use of all levels of technical and administrative staff of WASIP-Mali. Only the Coordinator, a bilingual secretary and a driver are paid from the Network funds. The Coordinator reports to the Executive Director of ICRISAT Sahelian Center (ISC) in Niamey and is in close consultation with the Team Leader of WASIP-Mali. Direct links exist between the Coordinator and SAFGRAD Coordinating Office (SCO) in Ouagadougou. Yearly progress reports are prepared by the Coordinator and submitted to USAID, Ouagadougou through the Executive Director. The Coordinator disburses funds for the activities of the Network and financial reports are prepared on a monthly basis by WASIP-Mali accounts section. These financial reports are sent directly to ICRISAT Center (IC) in Hyderabad, India, which has the responsibility to submit them to USAID in Ouagadougou.

Major recommendations are made by representatives from NARS at regional workshops which are held every two years. Members of the Steering Committee are also elected at these workshops. The present Steering Committee consists of representatives from six member countries and the Coordinator as follows:

- Mali (Chairman)
- Burkina Faso
- Cameroon

- Niger
- Nigeria
- Chad
- Coordinator.

Representatives from SAFGRAD, USAID, Insitut du Sahel (INSAH) and IRAT regularly attend as observers. The Steering Committee recently decided that the Team Leaders of both ICRISAT's Mali and Nigeria teams should always be invited to attend as observers. Global 2000 has recently been invited as an observer. The Team Leaders and Global 2000 were present at the eighth Steering Committee meeting in December in Bamako.

REGIONAL TRIALS AND NURSERIES

1986

The West African Sorghum Adaptation Trials were organized by the SAFGRAD/ICRISAT West African Sorghum Improvement Program, as per the recommendations of the Steering Committee of WCASRN.

During 1986, three regional trials were organized. These were the West African Sorghum Variety Adaptation Trial early and medium duration varieties (WASVAT-Early and Medium) and the West African Sorghum Hybrid Adaptation Trial (WASHAT). The variety trials comprised of 20 entries each while the hybrid trial comprised of 36 entries, including controls. The regional trials comprised of elite breeding lines and hybrids contributed by ICRISAT and the National Sorghum Programs of Burkina Faso and Mali. The entries included in the trials were mostly

of recent origin and represented promising lines from various breeding programs. Cooperators in the national programs were expected to select useful entries from these trials for further testing and advancement in their countries.

Seeds of WASVAT-Early were dispatched to cooperators in nine countries. Results were received from seven locations in five countries. In general, results from five locations were satisfactory and were included in the statistical analysis (Annexe 1). Grain yield data from two locations were excluded from statistical analysis because of high coefficient of variation. The overall means of individual entries were affected to some extent by the very high yields at Guiring location. Accross the five locations, ICSV 1078 BF was the highest yielder followed by the entries ICSV 1054 BF, ICSH-1 and ICSV 1055 BF. However, exclusion of the data from Guiring would show that the hybrid control ICSH-1 as the topmost yielder and ICSV 16-5 as another promising entry. The local control varieties yielded low at all the locations except Guiring where the improved control variety S-35 yielded the highest (6.84 t ha^{-1}). Examination of ranks across locations indicated that ICSH-1, ICSV 1078 BF, ICSV 1054 and ICSV 16-5 obtained high ranks consistently. Overall means of time to 50% flower among test entries ranged from 63 to 72 days.

Seeds of WASVAT-Medium were supplied to cooperators at twelve locations. Results were received from eight locations. However, grain yield data from two locations were not subjected to statistical analysis because of high coefficient of variation. Overall, the hybrid control ICSH-1 exhibited the highest yield (2.59 t ha^{-1}) across locations and was the most stable. Among the test entries, ICSV 1063 BF and IS 915 were the highest yielders. IS 915 was the highest yielder at Gampela and Karewa locations. The mean yield for the five locations ranged

from 7.66 t ha^{-1} to 2.59 t ha^{-1} (Annexe 1). The mean number of days to 50% flowering of the trial across locations ranged from 64 at Sotuba to 78 at Gampela.

Seeds of WASHAT where distributed to cooperators located in eight countries. The trial was planted at 15 locations. However, the experiments failed at three locations : Niangoloko (Burkina Faso), Sotuba (Mali) and Maradi (Niger), due to extremely late planting in poor fields. Grain yield data was received from 12 locations among which Saria, Fada and Atetou exhibited high coefficient of variation (> 30%). Considering the experimental conditions described by the cooperators and the high coefficients of variation, data from these locations were not considered for the calculation of overall mean yields. At the location Di (Burkina Faso, irrigated off season crop), night temperatures were very low during the anthesis period and resulted in partial sterility of some hybrids. Data from such entries were deleted from the statistical analysis. At the location Guiring, grain yields of individual entries were as high as 6.37 t ha^{-1} and were out of the range. Overall mean grain yields over nine locations showed that ICSH 230 ranked first (3.36 t ha^{-1}) followed by ICSH 229 (3.34 t ha^{-1}), ICSH 208 (3.24 t ha^{-1}). The mean yields ranged from 2.24 t ha^{-1} to 3.36 t ha^{-1} (Annexe 1). The hybrids ICSH 230, ICSH 229 and ICSH 231 have the common female parent ICSA 11. In general, hybrids of ICSA 11 exhibited relatively higher ranks at many locations and better overall mean performance. Other top yielding hybrids were ICSH 134 and ICSH 208. Overall mean number of days to 50% flower of test hybrids ranged from 57 to 68.

1987

Three regional sorghum adaptation trials were conducted. WASVAT-Early and Medium had 20 entries each. Seeds for WASVAT Early and Medium were sent to 10 and 14 countries, respectively. The third trial was WASHAT which had 25 entries and was sent to seven countries. Those trials were conducted for the second consecutive year and the entries were elite varieties and hybrids furnished by ICRISAT and by the national programs of Burkina Faso, Cameroon, Ghana, Mali, and Niger. Most of the entries in the WASVATs were tested for the first time, whereas the others represent the best entries from 1986. Results for 1987 were obtained from 9, 12, and 15 locations for WASVAT-Early, WASVAT-Medium, and WASHAT, respectively. Because of high coefficient of variation, only data from 7 locations for both the WASVATs and from 10 locations for WASHAT are presented. For WASVAT-Early, the variety Nagawhite had the highest mean yield (2.80 t ha^{-1}) for all seven locations and for WASVAT-Medium, it was ICSV 1063 BF with a mean yield of 2.58 t ha^{-1}. For WASHAT, ICSH 336 had the highest mean yield (2.80 t ha^{-1}) for all ten locations (Annexe 1).

The West African Sorghum Disease Resistance Nursery (WASDRN) was sent for the first time in 1987 to five countries and was grown in six locations. The nursery had 36 entries of which 20 were promising genotypes observed for resistance to leaf diseases in preliminary observation nurseries of ICRISAT's Burkina Faso Pathology program since 1985. They originated from ICRISAT's breeding program in Burkina faso. Thirteen of these lines were agronomically promising germplasm lines and the remaining three were susceptible controls. Results received from five locations indicate that six genotypes, 84 W 19, 84 W

848, ICSV 85-4, ICSV 1034 BF, IS 9928, and IS 21658 had low severity scores, 3.5 or less on a 1-6 scale, for the prevalent leaf diseases in all locations.

1988

WASVAT-Early duration consisted of 20 entries and 14 sets were sent to seven countries. The 20 varieties were the same as for 1987 and entries included varieties from Cameroon, Ghana, Mali, Senegal, and WASIP. Results were received from 10 locations. The variety Nagawhite had the highest mean yield (3.53 t ha^{-1}) for all 10 locations (Annexe 1). The overall mean days to 50% flowering ranged from 64 to 76 days. WASVAT-Medium duration also consisted of the same 20 entries as in 1987, and 19 sets were sent to 15 countries. Varieties were contributed by Burkina Faso, Cameroon, Mali, Niger and ICRISAT-WASIP. Results were received from 11 locations. The results for grain yield are given in Annexe 1. The coefficients of variation were higher than 40% for five locations. Thus, only yield data for the remaining six locations are given. The variety ICSV 1063 BF had the highest mean yield (3.34 t ha^{-1}) for all six locations. The overall mean days to 50% flowering ranged from 69 to 85 days. West African Sorghum Hybrid Adaptation Trial (WASHAT) consisted of 20 entries and was grown at 12 locations in seven countries. Results for grain yield from seven locations are given in Annexe 1. The hybrids ICSH 507 ranked first for mean yield (3.31 t ha^{-1}) of all seven locations, and exhibited consistent performance across locations. Overall mean time to 50% flowering ranged from 66 to 76 days.

West African Sorghum Disease Resistance Nursery contained the same 36 entries as in 1987 and was grown at seven locations in six countries. The objective of WASDRN is to identify stable resistance to the important leaf

diseases of sorghum in West Africa. The leaf diseases, leaf anthracnose (*Colletotrichum graminicola*), sooty stripe (*Ramulispora sorghi*) and gray leaf spot (*Cercospora sorghi*) are important in West Africa. Three genotypes, 84 S 82, 84 S 103-3, and 84 S 130, had low levels of infection to these three leaf diseases at all seven locations. Sooty stripe severity was very low, disease score of 3 or less in the 1-6 scale, at all locations except Bengou in Niger.

The West African Sorghum *Striga* Trial (WASST) was organized for the first time at the request of several national programs. The trial consisted of 11 entries which had been tested by ICRISAT in fields with high *Striga* infestation and one local control. The trial was sent to Cameroon, Ghana, Mali, Niger, Nigeria, and Togo, and results were received from Cameroon, Ghana, and Mali. The results showed that IS 9830 and ICSV 1007 BF are promising lines for *Striga* resistance.

1989

The West African Sorghum Variety Adaptation Trial (WASVAT-89) was conducted in 1989 and comprised both early and medium-duration cultivars. Each trial consisted of 20 entries contributed by the West African Sorghum Improvement Program (WASIP) and by the national programs of Benin, Burkina Faso, Cameroon, Ghana, Mauritania, Niger and Senegal. Mean yield for WASVAT early-duration from 10 locations ranged from 1.27 to 2.85 t ha^{-1}. The cultivar ICSV 1079 had the second highest overall mean yield of 2.74 t ha^{-1} followed by CS 61 (2.65 t ha^{-1}) and ICSV 111 IN (2.55 t ha^{-1}). One of the controls, Nagawhite, had the highest mean yield of 2.85 t ha^{-1}. In the medium-duration trial results from nine locations indicated that the

cultivars ICSV 1171 BF had the highest overall mean yield of 2.37 t ha^{-1} followed by F2-20 (2.34 t ha^{-1}) and CS 95 (2.32 t ha^{-1}) (Annexe 1). The mean time to 50% flowering for all entries was between 64 and 74 days for WASVAT early, and between 72 and 97 days for WASVAT medium.

The West African Sorghum Hybrid Adaptation Trial (WASHAT-89) had 20 entries. Results from eight locations indicated that the highest yielding hybrids were ICSH 507 (3.66 t ha^{-1}), ICSH 780 (3.60 t ha^{-1}), and the hybrid from the national program of Niger TX 623 A X MR 732 (3.58 t ha^{-1}) (Table 3) (Annexe 1). The overall mean time to 50% flowering was between 58 and 79 days.

Although 10 sets of the disease nursery was sent to nine countries, results were received from only two countries. The scores for the results were received from only two countries. The scores for the 25 entries were given for gray leaf spot and leaf anthracnose at both sites. Twenty two out of 25 entries and all 25 entries had mean scores of less than 3 on a 1-6 scale, for anthracnose and gray leaf spot, respectively at both sites. The most resistant lines for both diseases included 84 S 82, 84 S 130, 84 S 103-2, and IS 3443.

The *Striga* trial was sent to nine countries and results were received from six countries. The promising lines for *Striga* resistance included ICSV 1001 BF, ICSV 1007 BF, ICSV 1164 BF, and IS 9830.

1990

The trials for 1990, the countries they were sent to, and the number of sets sent to each country are given in Table 1. At the fifth Steering Committee of WCASRN in May 1989, it was recommended that national programs should be asked to closely evaluate certain varieties that have shown some promise over the years. A technical information sheet for this purpose was prepared (annexe 1). These varieties are ICSV 1063 BF, CE 180-33, ICSV 111 IN, ICSV 1083 BF and Malisor 84-1. The number of entries and the number of countries and locations to which seeds were dispatched and from which results were analyzed for the regional trials and nurseries between 1986 and 1989 are given in Table 2.

RESEARCH PROJECTS WITH NATIONAL AGRICULTURAL RESEARCH SYSTEMS

Projects' Descriptions and Objectives

The West and Central Africa Sorghum Research Network initiated four research projects in four NARS in June 1989. These projects are leaf anthracnose (*Colletotrichum graminicola*) in Burkina Faso, long smut (*Tolyposporium ehrenbergii*) in Niger, head bug (*Eurystylus sp.*) in Mali and technology of wheat-sorghum composite flour in Nigeria. Project titles, funds made available and reports received are summarized in Table 3. The main objectives of the anthracnose project are to determine whether pathotypes of the pathogen occur in Burkina Faso and to identify genotypes resistant to the pathotypes. The objective of the long smut project in Niger is to develop a simple and effective inoculation method for use in screening techniques. The project on head bug in

Mali emphasizes among other things, the biology of the insect, its economic importance, and identification of resistant sources. In Nigeria, the project scientists hope to develop a technology for producing acceptable wheat-sorghum composite flour for bread and confectionery, aimed at increasing the sorghum component as high as possible.

A project on identification of *Striga* resistant lines started in 1990 by the Cameroon national program. Each of these projects received $ 5,000 per year for 1989 and 1990. At the eighth Steering Committee meeting, it was decided to increase this amount to $ 8,000 per project for 1991.

SYNTHESIS OF PROGRESS MADE

Regional Trials

The yields in tons ha^{-1} of the two genotypes with the highest overall mean yield across locations in WCASRN's regional trials and nurseries between 1986 and 1989 are given in Table 4. Some NARS have found other genotypes not mentioned in Table 4 suitable for their programs. Some of these lines in pre-release or advanced stages in respective NARS are given in Table 5. In 1990, NARS were encouraged to send promising lines from their respective programs to the Coordinator for off-season multiplication, so that they could be included as entries in the 1991 trials and nurseries. Seeds for the varietal trials were received from nine NARS and were multiplied at ICRISAT Mali off-season facilities. Details of the varieties received and number of rows multiplied are given in Table 6. Table 7 contains entries that will go into the 1991 disease nursery. Most of the lines

for the disease nursery had been observed for the past two years by ICRISAT's program, and include BF lines from Burkina Faso. Nine varieties were received from the national program of Cameroon for the 1991 *Striga* trial (Table 7). Scientists from the Mali national program and ICRISAT's West African programs intend to contribute entries for the 1991 varietal and *Striga* trials. ICRISAT's program in Kano will provide the hybrids for 1991. It is hoped that this approach will increase the number of entries from NARS in these trials and nurseries.

During the eighth Steering Committee of WCASRN held in Bamako on 3-4 December 1990, it was decided that seeds of ICSV 1083 BF, CE 180-83, ICSV 111, of WASVAT-Early and ICSV 1063 BF, ICSV 1089 BF, Malisor 84-1 of WASVAT-Medium cycle trials should be multiplied. Multilocational trials were recommended for 1991 to further test these six varieties. It was recommended that the multiplication of these varieties be coordinated with INSAH. A clearly defined strategy for the exploitation of new varieties needs to be developed during the joint network workshop. NAR cooperators in the multilocational trials will be requested to fill out technical information forms on the varieties under evaluation. These forms have been prepared and an example is give in Annexe 1.

Research Projects

A working group meeting on the research projects on leaf anthracnose (Burkina Faso), long smut (Niger), and head bugs (Mali) was held in Bamako between April 19 and 20. Results of the first years' work were presented and future plans were discussed. The principal investigators, evaluators from the national programs of

Burkina Faso, Niger, and Mali, and resource persons from ICRISAT's Regional Program and FAO in Mali participated.

Using the spreader row technique, the project in Burkina Faso screened a total of 80 sorghum lines, of which 56 were local varieties and 24 were introduced genotypes. Seventy-four out of the 80 lignes tested were resistant (mean score of 3 of less in a 1-6 scale) to the foliar stage of the disease. Of the six susceptible lines, four were introduced genotypes. Only one introduced genotype was susceptible to stem infection. Grains of thirty out of the 80 lines were free of the fungus. The level of grain contamination by *C. graminicola* was higher in introduced genotypes. In addition to confirming these first year results, work on the variability of the pathogen will be undertaken during the second year.

Results from the project on head bugs in Mali indicated that the population of *Eurystylus marginatus* was more abundant towards the end of September and October. Early planting resulted in no attack by *E. marginatus*, whereas two generations of the insect developed in late planted sorghums. In a screening experiment 25 out of 100 lines were resistant to *E. marginatus*. Further resistant lines were identified in an advance trial and in an international nursery. A limited survey in farmer's fields revealed that in certain localities, *E. marginatus* attack was higher in introduced lines than in locals. However, the level of attack depended on the locality, and some local varieties were severely attacked in some areas. Work will continue on these aspects of the project during the second year.

The project on long smut in Niger encountered problems with flooding in the field due to high rainfall. In addition, attempts on artificial inoculation were unsuccessful.

A working group meeting on the project in Nigeria was held on September 13 to 14 at the Institute of Agricultural Research in Zaria. In brief, the results from this project indicate that the local variety Farafera was identified as a suitable sorghum variety for wheat-sorghum composite bread and confectionery. In the laboratory, acceptable bread can be produced with up to 50% level of wheat substitution by sorghum. Similarly, acceptable confectionery can be produced with up to 60% level of substitution with sorghum. Generally, composite bread is of lower volume and of shorter shelflife than 100% wheat bread. Future work will emphasize the area of pilot production. The technology developed at the laboratory level will be followed by pilot production. Two bakeries, one for bread and another for confectionery with pilot baking facilities will be involved. The economics of production will be determined.

New forms for project description, project progress reports, financial reports, and project evaluation are now available. Examples of these are given in Annexe 2.

Another development with respect to the project in Burkina Faso and Mali is that some of the varieties which showed resistance to leaf anthracnose and head bugs were multiplied during the 1990/91 off-season at ICRISAT's facilities in Mali. These lines are given in Table 8. Those for which their resistance are confirmed during 1990 will be sent to interested NARS either for direct use in their breeding programs as sources of resistance or for further testing.

ANTICIPATED FUTURE THRUST OF THE NETWORK

The following activities are proposed under the grant for Phase III:

a) Expand on-going research projects with NARS and initiate new ones. Thus, it is envisaged that the Network will become more of a "research" network than a "trials" network;

b) Organize in-service training in various disciplines, but with emphasis on agronomy and food technology;

c) Supervise seed multiplication and dispersal of regional trials and nurseries both by ICRISAT and by strong NARS with the requisite capability;

d) Degree training up to M.Sc. and Ph.D levels according to the needs of the NARS;

e) Assist the NARS in developing promising varieties and hybrids with high and stable yields;

f) Facilitate the exchange of germplasm between member states;

g) Organize annual research working groups on the research projects with active participation of NARS;

h) Organize germplasm collection and evaluation within agronomic packages for the NARS;

i) Organize once every two years scientific meetings and regional workshops as the forum for evaluating progress and planning for the future;

j) Organize monitoring tours in years when scientific meetings and regional workshops are not scheduled.

k) Agronomy based regional trials to evaluate elite genotypes at different technological levels such as fertility level of N and P, land preparation methods, and plant populations. Also genotypes in sole versus intercropping trials. Information needed from research sites include rainfall and soil analysis. These trials should be conducted initially on-station but extended to on-farm sites by year 2 or 3.

An enormous effort will be made to ensure the flow of technology developed in the Lead Centers where research projects are carried out, to the Associate Centers. In shifting the overall emphasis of the Network from a "trials Network" to a "research Network", this activity will become a priority. The role of a research associate as a Network staff will be extremely important in this regard by working closely with principal investigators in the Lead Centers, researchers in the Associate Centers, and encouraging the Technology Adopting Centers to implement the "finished" product. The basis for the terms, Lead, Associate and Technology Adopting Centers are given in Table 9. Training requirements for the NARS will closely follow the classification in Table 9.

CONCLUSION

There are many components in an overall strategy to improve sorghum production in semi-arid West Africa. If these components are well defined and are tailored towards the needs of the region on a strictly priority basis, then the facets in a strategic plan become clearer and less complex. For example, training should concentrate on upgrading present staff and replacing expatriates rather than training to fill new posts (Eicher, 1988). Eicher (1988) also suggested that the effectiveness of regional research networks could be enhanced if sub-regional geographical units formed the operational units for developing research strategies. This suggestion is in line with one of SAFGRAD's thrusts on research program activities which is to promote the improvement of food grains by supporting regionally oriented research in sub-Saharian Africa (Bezuneh, 1987). A strategic priority in the 1990's should be the strengthening of national commodity research teams on a few priority commodities (Eicher, 1988).

During the past several years, WCASRN has made some modest impact in contributing to some of these philosophies underlying the overall strategy for sorghum improvement in West and Central Africa. For example, some of the improved varieties in the regional trials have been tested by NARS and some are in the advanced stages of testing. In Mali, ICSV 1063 BF and ICSV 1079 BF were tested on farmers' fields and ICSV 1063 BF produced superior grain yields over the local variety. This variety was be tested in several villages during the 1990 crop season. ICSV 111 IN and M 66118 have received greater attention in Ghana. ICSV 1063 BF and Mali Sor 84-1 were included in on-farm tests by extension agencies in Côte d'Ivoire. Promising sources of resistance to the prevalent leaf diseases

and to *Striga* have been identified through the leaf disease nursery and the *Striga* trial.

The five collaborative projects have created further incentive to scientists in NARS to engage in research. Working group meetings on these projects are planned for this year, in which experts from NARS will meet and discuss results obtained and future work plans. Scientists in NARS are thus interacting to solve common problems.

Training workshops and regional tours provided a broader forum for interaction between NARS scientists. For example, regional tours enabled NARS scientists to visit trials and nurseries of neighboring countries, to evaluate the materials they saw, and to select those they found interesting for use in their programs.

There is a lot more to be done through WCASRN especially in the area of agronomy and training. The approaches the Network use to meet its objectives should be constantly evaluated and revised. More inputs from the 17 member countries especially in the area of management of the Network, is envisaged for the future.

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Table 1. West and Central African Sorghum Research Network's 1990 regional trials and nurseries.

	Trials and number of sets				
	WASVAT				
	Early	Medium	*Striga*	Diseases	WASHAT
Benin	0	1	1	0	1
Burkina Faso	2	2	0	1	2
Cameroon	1	1	1	1	2
Central Afr. Rep.	0	1	0	0	0
Côte d'Ivoire	0	1	0	0	2
Gambia	1	1	0	0	0
Ghana	1	2	1	1	2
Guinea	0	1	0	1	0
Guinea Bissau	0	1	1	1	0
Mali	1	1	1	1	3
Mauritania	1	0	0	0	0
Niger	1	1	1	1	3
Nigeria	2	2	4	0	1
Senegal	1	1	0	0	0
Sierra Leone	1	1	0	0	0
Tchad	1	1	0	0	0
Togo	1	0	1	0	0
Total	14	18	11	7	16

Table 2. Number of entries and the number of countries and locations to which seeds were dispatched and from which results were analyzed for the trials and nurseries of the West and Central Africa Sorghum Research Network between 1986 and 1989[1].

Year and trial	Dispatched			Results analysed	
	Entries	Country	Location	Country	Location
1986					
WASVAT-E	20	5	7	4	5
WASVAT-M	20	5	8	4	6
WASHAT	36	8	15	6	12
1987					
WASVAT-E	20	10	15	4	7
WASVAT-M	20	14	15	6	7
WASHAT	25	7	15	6	10
1988					
WASVAT-E	20	10	14	8	10
WASVAT-M	20	15	19	4	6
WASHAT	20	7	12	5	7
WASDRN	36	6	7	6	7
WASST	11	6	6	3	3
1989					
WASVAT-E	20	12	16	7	10
WASVAT-M	20	16	19	7	9
WASHAT	20	6	9	6	8
WASDRN	25	9	10	6	6
WASST	11	9	9	2	2

1. WASVAT-E, WASVAT-M = West African Sorghum Variety Adaptation Trial, Early (E) and Medium (M) cycles. WASHAT = West African Sorghum Hybrid Adapatation Trial. WASDRN = West African Sorghum Disease Resistance Nursery. WASST = West African Sorghum *Striga* Trial.

Table 3. Country, project title, amount paid so far and reports received for the five research projects of WCASRN.

Country	Project title	Amount paid and date $	CFA	Date	Report received
Burkina Faso	Identification of sources of resistance to leaf anthracnose of sorghum (*Sorghum bicolor*) caused by *Colletotrichum graminicola* (ces) Wilson in Burkina Faso	2500	877500	28/6/89	Preliminary, 1989
		2500	787238	24/11/89	First year, 1989
		2500	712500	22/6/90	
Cameroon	Screening of local germplasms of Cameroon and other countries against *Striga hermonthica* in heavily infested field conditions	2500	705000	29/6/90	None
Mali	Studies on head bugs of sorghum in Mali	2500	827500	26/6/89	Preliminary, 1989
		2500	790000	25/10/89	First year, 1989
Niger	Identification of resistance to long smut	2500[1]			Preliminary, 1989
		2500[1]			
Nigeria	Technology for production of acceptable wheat-sorghum composite bread and confectionery	2500[2]			Preliminary, 1989
		2500[2]			First year 1989/90

1. Paid through ICRISAT Sahelian Center, Niamey.
2. Paid through ICRISAT, Kano.

Table 4. Yield in tons ha^{-1} of the two genotypes with the highest overall means (variety and hybrids) and promising genotypes for leaf disease and *Striga* resistance in WCASRN's regional trials, 1986-1989.

Year	Trial/ Nursery	Genotype	Yield (t ha^{-1})	Origin Institution/Country
1986	WASVAT-E	ICSV 1078	3.66	ICRISAT-Mali
		ICSV 1054	3.52	ICRISAT-Mali
	WASVAT-M	ICSV 1063	2.55	ICRISAT-Mali
		IS 915	2.40	ICRISAT Center germplasm
	WASHAT	ICSH 230	3.36	ICRISAT-Nigeria
		ICSH 229	3.34	ICRISAT-Nigeria
1987	WASVAT-E	Nagawhite	2.80	Ghana
		ICSV 111 IN	2.57	ICRISAT Center
	WASVAT-M	ICSV 1063	2.58	ICRISAT-Mali
		ICSV 1089	2.56	ICRISAT-Mali
	WASHAT	ICSH 336	2.80	ICRISAT-Nigeria
		ICSH 232	2.75	ICRISAT-Nigeria
	WASDRN	IS 9928	-	ICRISAT Center germplasm
		IS 21658	-	ICRISAT Center germplasm
1988	WASVAT-E	Nagawhite	3.53	Ghana
		ICSV 210 IN	3.41	ICRISAT-India
	WASVAT-M	ICSV 1063	3.34	ICRISAT-Mali
		Malisor 84-1	3.08	Mali/ICRISAT Bilateral
	WASHAT	ICSH 507	3.32	ICRISAT-Nigeria
		ICSH 330	3.09	ICRISAT-Nigeria
	WASDRN	84 S 82	-	ICRISAT-Mali
		84 S 130	-	ICRISAT-Mali
	WASST	IS 9830	-	ICRISAT Center germplasm
		ICSV 1007	-	ICRISAT-Mali
1989	WASVAT-E	ICSV 1079	2.74	ICRISAT-Mali
		CS 61	2.65	Cameroon
	WASVAT-M	ICSV 1171	2.37	ICRISAT-Mali
		F2-20	2.34	Senegal
	WASHAT	ICSH 507	3.66	ICRISAT-Nigeria
		ICSH 780	3.60	ICRISAT-Nigeria
	WASDRN	84 S 82	-	ICRISAT-Mali
		84 S 130	-	ICRISAT-Mali
	WASST	IS 9830	-	ICRISAT Center germplasm
		ICSV 1007	-	ICRISAT-Mali

1. WASVAT-E, -M = West African Sorghum Variety Adaptation Trial, early and medium duration. WASHAT = West African Sorghum Hybrid Adaptation Trial. WASDRN = West African Sorghum Disease Resistance Nursery. WASST = West African Sorghum *Striga* Trial.

Table 5. Varieties in prerelease stage or advanced stage in some NARS.

Country	Varieties
Burkina Faso	Sudanian zone: ICSV 1002 BF, E 35-1, 80 W 68, ICSV 1049 BF, Framida, ICSV 126 IN, 193-2, SPV 35, ICSV 16-5 BF North Guinea Zone: SPV 35, ICSV 111 IN, ICSV ICSV 1002 BF, IS 6928, Framida, E-35-1, 84 W966
Niger	SEPON 82: Multilocation trials with extension services SRN 39 (ICSV 1007 BF): on-farm and on station *Striga* resistance trials S 35: same stage as SRN 39
Ghana	Multilocation trials in northern region: ICSV 111 IN, ICSV 1087 BF, ICSV 1078 BF, ICSV 16-5 BF, ICSV 210 IN, ICSV 1054 BF, ICSV 1093 BF, ICSV 1063 BF, ICSV 1089 BF, ICSV 1092 BF
Togo	ICSV 111 IN and M 66118 - advanced farmers' tests SEPON 82 in multilocation trials ICSV 1007 BF - *Striga* resistance
Côte d'Ivoire	ICSV 1063 BF and Mali Sor 84-1 in on-farm multilocation testing
Nigeria	ICSV 1002 BF and ICSV 1007 BF for *Striga* resistance
Sierra Leone	Mali Sor 84-7 in multilocation testing
Guinea-Bissau	ICSV 126 IN and ICSV 1074 BF in multilocation testing
Central African Republic	ICSV 1063 BF and ICSV 1093 BF
Mali	ICSV 1063 BF and ICSV 1079 BF in multilocation and on farm testing

Table 12. Mean grain yield (t ha^{-1}) of selected hybrids in the West African Sorghum Hybrid Adaptation Trial (WASHAT) at eight locations in West Africa, rainy season 1989[1].

Entry	Mali				Niger				Nigeria		Cameroon		Côte d'Ivoire		Burkina Faso		Overall	
	Sotuba		Samanko		Tarna		Lossa		Bagauda		Guiring		Bouaké		Farako-Ba			
	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank
ICSH 507	3.40	7	2.93	11	4.84	2	1.70	8	5.48	1	7.64	2	2.08	2	1.22	5	3.66	1
ICSH 760	3.32	10	3.40	5	3.48	17	2.74	4	5.43	2	7.54	3	1.43	5	1.47	4	3.60	2
Tx623AxMR732	3.71	1	3.07	7	5.33	1	2.92	1	4.33	14	6.95	11	1.34	11	1.03	11	3.58	3
ICSH 89002	3.41	6	3.51	3	4.41	6	1.67	10	4.92	6	7.98	1	1.51	3	1.14	9	3.57	4
ICSH 89001	2.33	19	2.98	10	4.27	5	2.29	3	4.89	7	7.06	9	2.09	1	1.79	2	3.46	5
ICSH 479	3.54	4	2.89	12	3.61	14	1.81	7	5.23	4	7.21	5	1.02	17	1.56	3	3.36	6
Controls																		
ICSH 109	2.69	16	3.09	9	4.55	4	1.81	7	4.21	15	6.00	17	1.06	16	0.49	15	2.99	17
ICSH 111	2.44	18	3.00	8	3.55	16	1.63	11	3.34	17	6.07	16	1.95	3	1.52	1	2.98	18
Local	3.07	12	1.44	18	3.62	13	1.08	14	4.69	10	6.65	13	1.08	15	0.93	13		
SE	±0.55		±0.31		±0.37		±0.53		±0.81		±0.54		±0.39		±0.41			
Trial mean (20 entries)	3.06		2.88		3.93		1.77		4.49		6.80		1.33		1.09			
CV (%)	18		11		16		30		16		8		30		37			

1. Randomized block design with three replications. Numbers following each yield value indicate the ranking of the cultivars. Local control different at each location.

Table 11. Mean grain yield (t ha^{-1}) of the highest yielding medium-duration cultivars in the West African Sorghum Variety Adaptation Trial (WASVAT) at 9 locations in West Africa, rainy season 1989.

Entry	1		2		3		4		5		6		7		8		9		Overall[2]	
	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank
ICSV 1171 BF	3.71	1	2.74	2	1.84	1	1.20	4	2.71	3	4.03	3	2.68	8	4.63	1	0.18	11	2.37	1
F2-20	2.91	9	2.78	1	1.32	5	1.32	2	2.73	2	3.50	6	2.41	11	4.45	5	0.32	3	2.34	2
S-95	2.45	13	2.66	3	1.63	3	1.30	3	2.50	7	4.35	1	2.58	9	4.75	2	0.42	1	2.32	3
ICSV 1089 BF	2.94	8	1.97	12	1.51	5	1.00	8	2.42	9	3.48	7	2.81	7	4.03	10	0.07	15	2.29	4
SEPON-82	3.32	2	2.35	6	1.67	2	1.15	5	2.65	5	4.31	2	2.93	4	4.44	6	0.18	11	2.25	5
ICSV 1163 BF	3.03	6	2.42	5	1.54	4	1.32	2	2.23	12	3.73	4	2.83	6	4.74	3	0.24	6	2.17	6
BF-82-4/4-1-1	2.98	7	2.29	8	1.39	7	1.20	4	2.83	1	2.38	12	2.41	11	4.14	9	0.22	7	2.14	7
ICSV 1063 BF	2.65	11	2.19	10	1.40	6	1.13	6	2.58	6	3.36	8	3.38	2	3.83	11	0.21	8	2.11	8
ICSV 1157 BF	2.64	12	2.32	7	0.68	14	1.12	7	2.17	13	3.63	5	2.50	10	4.32	7	0.26	5	2.06	9
Control																				
Local	2.35	14	2.65	4	1.31	9	1.39	1	1.44	16	1.79	14	0.26	19	4.16	8	0.24	6		
SE	± 0.31		± 0.26		± 0.19		± 0.15		± 0.22		± 0.32		± 0.37		± 0.17					
Trial mean (20 entries)	2.67		2.00		1.11		0.89		2.04		2.76		2.32		3.89		0.20			
CV (%)	20		22		30		30		18		20		28		13					

1. Locations : 1 = Farako-Ba, 2 = Saria in Burkina Faso; 3 = Manga Bawku in Ghana; 4 = Sotuba, 5 = Samanko in Mali; 6 = Bengou in Niger; 7 = Bagauda in Nigeria; 8 = Nioro in senegal; 9 = Tantiegou in Togo. Numbers following each yield value indicate the ranking of the cultivars.

2. Randomized-block design with three replications, plot size ranged from 6.0 m^2 to 14.4 m^2. Local control different at each location.

Table 10. Mean grain yield ($t_2 ha^{-1}$) of the highest yielding early-duration cultivars in the West African Sorghum Variety Adaptation Trial (WASVAT) at 10 locations in West Africa, rainy season 1989[2].

Entry	1		2		3		4		5		6		7		8		9		10		Overall	
	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank
ICSV 1079 BF	2.84	2	3.16	2	3.24	7	2.29	4	2.40	6	2.74	13	4.83	2	3.18	1	1.45	1	2.71	3	2.74	1
CS-61	2.99	4	1.94	18	3.54	2	2.40	1	1.96	11	3.24	9	4.98	1	2.96	3	1.25	4	2.57	8	2.65	2
ICSV 111 IN	2.38	9	2.70	7	3.16	9	1.99	10	1.60	16	3.33	7	4.73	3	2.72	6	1.37	2	2.89	1	2.55	3
ICSV 1172 BF	2.55	7	3.16	3	3.25	6	1.83	14	2.00	10	3.46	5	4.59	4	2.48	9	0.46	19	2.28	11	2.47	4
CS-54	2.73	6	2.65	8	3.28	5	1.91	13	2.02	9	2.69	14	3.96	10	2.84	4	1.12	5	2.79	2	2.45	5
ICSV 1177 BF	2.10	12	3.46	1	3.10	10	2.40	3	1.90	12	2.75	12	3.90	13	2.03	15	0.94	9	2.71	3	2.44	6
ICSV 1176 BF	3.03	3	2.75	6	2.60	16	2.03	8	2.67	4	3.42	6	3.84	14	2.51	8	0.80	11	2.11	13	2.40	7
ICSV 401 IN	3.17	2	2.44	13	2.61	15	2.16	6	2.48	5	2.61	15	4.29	6	2.97	2	0.96	8	1.90	15	2.35	8
ICSV 1125 BF	2.13	10	2.54	10	2.89	12	1.92	12	1.79	13	3.50	3	4.47	5	2.41	10	0.72	15	2.23	12	2.37	9
Controls																						
Nagawhite	2.73	6	2.95	4	3.75	1	2.67	1	2.73	3	5.49	1	4.15	9	2.51	9	0.75	14	2.49	10	2.55	1
Local	2.01	15	2.25	15	3.35	3	1.72	17	2.17	7	4.53	2	3.93	11	2.75	5	0.83	10	2.67	4		
SE	± 0.32		± 0.20		± 0.18		± 0.18		± 0.26		± 0.43		± 0.36		± 0.14		± 0.29		± 0.21			
Trial mean (20 entries)	2.30		2.55		2.95		2.06		1.96		2.93		3.92		2.27		0.88		2.40			
CV. (%)	24		18		11		15		23		25		16		22		28		26			

1. Locations: 1 = Farako-Ba, 2 = Saria in Burkina Faso; 3 = Guiring in Cameroun; 4 = Cinzana, 5 = Samanko in Mali; 6 = Maradi in Niger; 7 = Bagauda in Nigeria; 8 = Nyankpala, 9 = Manga Bawku in Ghana; 10 = Bambey in Senegal. Numbers following each yield value indicate the ranking of the cultivars.

2. Randomized-block design with three replications, plot size ranged from 5.5 m^2 to 14.4 m^2. Local control different at each location.

Table 9. Mean grain yield (t ha-1) of selected hybrids in the West African Sorghum Hybrids Adaptation Trial (WASHAT) at seven locations in West Africa, rainy season 1988[1].

Entry	Mali		Niger		Nigeria	Burkina Faso	Côte d'Ivoire	Mean
	Samanko	Cinzana	Kolo	Tarna-2	Bagauda	Farako-Ba	Ferké	
ICSH 507	3.67 4	3.16 2	3.54 1	4.14 6	3.98 1	3.05 1	1.66 1	3.32
ICSH 330	3.87 2	2.99 4	3.28 3	4.49 4	3.25 4	2.45 3	1.32 3	3.09
ICSH 88042	3.93 1	3.06 3	2.88 4	4.61 3	3.14 5	2.39 4	1.19 4	3.03
ICSH 88040	3.84 3	2.75 5	3.31 2	4.75 2	3.28 3	1.74 6	0.77 5	2.92
ICSH 88038	3.40 5	3.38 1	2.67 5	4.92 1	3.11 6	2.26 5	0.70 6	2.92
ICSH 780	2.62 6	2.23 6	2.59 6	4.25 5	3.89 2	2.76 2	1.61 2	2.85
Controls								
ICSV 111	2.47	2.49	1.50	4.32	3.58	3.04	0.56	2.57 14
Local	1.00	2.14	1.65	2.72	1.41	1.77	1.52	1.74 20
SE	± 0.267	± 0.337	± 0.459	± 0.370	± 0.413	± 0.289	± 0.23	
Trial mean (20 entries)	3.08	2.54	2.57	4.01	3.11	2.28	1.08	
CV (%)	15	23	31	16	23	22	38	

1. Randomized-block design with three replications, plot size ranged from 6.4 to 19.4 m^2. Numbers following each yield value indicate the ranking of the cultivars.

Table 8. Mean grain yield (t ha^{-1}) of highest-yielding medium duration varieties in the West African Sorghum Variety Adaptation Trial (WASVAT) at six locations in West Africa, rainy season, 1988[1].

	Burkina Faso		Mali		Nigeria		
Entry	Farako-Ba	Saria	Sotuba	Samanko	Bagauda	Karewa	Mean
ICSV 1063 BF	3.45 1	4.66 11	4.33 1	1.20 3	3.00 4	3.42 3	3.34
Mali Sor 84-1	3.16 2	4.38 13	3.10 13	1.27 1	2.67 8	3.91 2	3.08
ICSV 1089 BF	2.81 3	4.90 8	3.45 7	0.91 11	3.31 2	2.67 13	3.01
BF 80-7-7-2-1	2.78 4	5.18 5	3.71 5	1.23 2	1.83 12	3.11 4	2.97
ICSV 1092 BF	2.38 10	4.38 13	3.18 11	1.12 5	3.48 1	2.71 12	2.88
BF 80-9-8-3-1	2.59 7	4.56 12	3.10 13	0.95 10	2.91 6	2.98 7	2.85
Control							
Local	1.61 17	2.23 20	3.11 12	0.65 20	0.83 20	4.44 1	2.15 18
SE	± 0.325	± 0.529	± 0.248	± 0.164	± 0.389	± 0.279	
Trial mean (20 entries)	2.25	4.58	3.31	0.98	2.41	3.02	
CV (%)	25	20	13	29	28	16	

1. Randomized-block design with three replications, plot size ranged from 6.4 to 19.4 m^2. Numbers following each yield value indicate the ranking of the cultivars.

Table 7. Mean grain yield (t ha^{-1}) of highest-yielding early duration varieties in the West African Sorghum Variety Adaptation Trial (WASVAT) at 10 locations in West Africa, rainy season 1988[1].

	L O C A T I O N[2]										
Entry	1	2	3	4	5	6	7	8	9	10	Mean
Nagawhite	4.78 1	2.88 19	2.86 1	2.59 7	3.79 5	6.35 2	3.60 2	3.00 4	2.98 5	2.44 4	3.53
ICSV 210-III	3.90 7	4.57 1	1.98 14	2.72 6	4.32 1	5.93 4	[illegible]05 4	3.18 5	1.95 8	2.54 3	3.41
ICSV [illegible]	[illegible].18 4	3.57 9	2.11 13	2.09 15	3.56 6	[illegible]2 3		2.81 8	3.19 3	2.60 2	3.27
S-35	3.32 13	3.51 10	1.69 17	1.93 17	4.15 3	5.55 9	3.69 1	2.44 16	3.19 3	2.81 1	3.23
ICSV 1087 BF	4.09 5	3.38 8	2.85 2	2.23 11	1.89 18	5.90 5	2.81 6	4.10 1	2.35 9	2.18 5	3.18
CE 180-33	2.95 15	3.77 3	1.83 16	3.36 1	4.25 2	5.50 10	2.39 11	2.61 13	3.31 2	1.68 8	3.17
Controls											
IRAT 204	3.66 12	2.76 20	2.23 9	2.41 10	0.72 20	5.27 15	2.22 12	3.39 4	2.16 11	1.36 14	2.62
Local	2.02 18	3.19 16	2.34 8	1.30 19	2.81 10	5.64 8	1.48 17	1.68 18	1.80 13	1.41 13	2.37
SE	± 0.483	± 0.344	± 0.202	± 0.289	± 0.333	± 0.442	± 0.334	± 0.339	± 0.475	± 0.194	
Trial mean (20 entries)	3.49	2.59	1.67	2.39	2.75	5.47	2.41	2.80	2.35	1.77	
CV (%)	24	23	21	21	21	14	24	21	35	19	

1. Randomized-block design with three replications, plot size ranged from 6.4 to 19.4 m^2.

2. Locations: 1 = Saria, Burkina Faso; 2 = Bema, Mali; 3 = Cinzana, Mali; 4 = Bagauda, Nigeria; 5 = Tarna, Niger; 6 = Maroua, Cameroon; 7 = Farako-Ba, Burkina Faso; 8 = Kolo, Niger; 9 = Bambey, Senegal; and 10 = Nyankpala, Ghana. Numbers following each yield value indicate the ranking of the cultivars.

Table 6. Mean grain yield (t ha^{-1}) of highest-yielding early duration varieties in the West African Sorghum Hybrid Adaptation Trial (WASHAT) at 10 locations in West Africa, rainy season 1987[1].

	LOCATIONS																				
Entry	1		2		3		4		5		6		7		8		9		10		Mean
ICSH 336	3.90	3	3.26	14	1.81	3	3.15	2	3.11	1	4.33	13	2.61	2	3.51	3	3.72	20	1.04	9	2.80
ICSH 232	3.28	13	3.51	6	2.07	1	3.42	1	2.56	11	4.72	1	1.64	16	3.61	2	4.29	10	0.98	11	2.75
ICSH 643	3.92	2	3.81	1	1.53	8	1.88	11	2.49	13	3.73	8	2.38	4	3.51	3	5.58	2	0.80	15	2.72
ICSH 642	3.39	9	3.34	9	1.92	2	1.70	14	2.75	6	2.87	22	3.16	1	1.44	1	4.90	5	0.98	11	2.64
ICSH 479	3.08	17	3.17	17	1.54	7	1.80	12	2.51	12	3.72	9	1.90	8	0.98	17	6.31	1	1.11	7	2.62
ICSH 229	3.12	16	3.23	15	1.52	19	3.15	2	2.73	8	3.55	11	2.27	5	1.07	5	3.92	16	1.44	2	2.56
Controls																					
ICSH 109	2.26	23	3.65	3	1.50	10	1.24	21	2.23	17	3.24	15	0.92	21	1.16	6	4.03	13	0.94	12	2.12
Hageen Durra	0.93	25	2.21	24	1.23	14	2.01	10	2.45	15	3.09	18	0.71	24	1.12	12	2.91	23	0.70	19	1.74
Framida	2.80	21	2.31	23	0.69	24	1.31	20	0.49	21	3.07	20	2.49	3	1.05	15	2.59	24	0.93	13	1.77
Nagawhite	3.24	14	3.50	7	1.10	15	1.23	22	2.20	18	3.97	5	1.86	12	0.91	19	3.09	22	1.19	5	2.23
Local variety	1.35	24	2.40	22	0.92	21	0.72	24	1.95	19	2.54	23	1.98	9	1.12	12	5.58	2	0.60	22	-
SE	± 0.27		± 0.26		± 0.23		± 0.39		± 0.29		± 0.39		± 0.31		± 0.06		± 0.64		± 0.19		
Trial mean	3.12		3.22		1.33		1.94		2.48		3.57		1.73		1.08		4.28		0.97		
CV (%)	15		14		30		35		20		19		31		10		26		35		

1. Locations: 1 = Farako-Ba, 2 = Saria, 3 = Fada, 4 = Gampela, 5 = Kolo, 6 = Sotuba, 7 = Ferké, 8 = Dapaong, 9 = Maroua, 10 = Bouaké. Lattice design (5 x 5), three replications. Plot size ranged from 7.5 to 8 m^2. Numbers following each yield value indicate the ranking of the cultivars.

Table 5. Mean grain yield (t ha-1) of highest yielding medium duration varieties in the West African Sorghum Variety Adaptation Trial (WASVAT) at seven locations in West Africa, rainy season 1987[1].

Variety	Farako-Ba	Saria	Sotuba	Ferkè	Samaru	Sapu	Nyankpala	Mean
ICSV 1063 BF	3.20 5	4.00 2	4.87 2	2.76 1	0.94 6	1.67 12	0.62 6	2.58
ICSV 1089 BF	3.52 1	4.26 1	4.49 3	1.33 8	1.50 1	2.29 6	0.59 12	2.56
M [illegible]581	3.26 4	3.35 8	5.04 1	[illegible]	0.93 7	2.67 3	0.56 9	2.48
Malisor 84-1	2.92 8	3.31 10	4.04 8	2.60 2	0.72 14	2.67 3	0.87 3	2.45
ICSV 1093 BF	2.97 7	3.55 4	4.15 7	1.35 7	0.87 10	2.54 4	0.58 8	2.29
BF 80-10-23-2-1	2.97 7	3.35 8	3.15 18	1.60 4	1.24 2	2.25 7	0.99 2	2.22
Controls								
Local	2.50 13	3.42 6	1.16 20	1.99 3	0.67 15	1.33 15	1.68 1	
SE	±0.45	±0.19	±0.44	±0.25	±0.15	±0.28	±0.30	
Trial mean (20 entries)	2.68	3.35	3.78	1.32	0.88	2.05	0.61	
CV (%)	29	10	20	33	30	24	31	

1. Randomized block design with three replications, plot size ranged from 7.5 to 8 m2 Numbers following each yield value indicate the ranking of the cultivars.

Table 3. Mean grain yield (t ha^{-1}) of highest yielding hybrids in the West African Sorghum Hybrid Adaptation Trial (WASHAT) at eight locations in West Africa, rainy season, 1986[1].

	Locations[2]								
Hybrid	1	2	3	4	5	6	7	8	Mean
ICSH 230	3.09 3	3.26 10	3.89 6	5.73 15	3.47 5	2.14 6	2.61 14	4.32 3	3.36
ICSH 229	3.02 5	3.59 3	4.17 3	5.93 3	2.50 11	1.90 12	2.78 9	4.31 4	3.34
ICSH 208	3.02 5	3.61 2	4.75 1	5.10 29	2.36 12	3.46 2	3.07 5	3.99 8	3.26
ICSH 134	2.71 10	3.36 8	4.17 3	5.93 9	3.47 5	1.70 18	3.06 6	3.14 21	3.24
ICSH 231	2.43 18	3.23 11	3.78 7	3.57 16	4.03 2	1.92 11	3.67 2	3.01 21	3.20
ICSH 178	3.24 1	2.95 16	2.64 19	5.53 18	3.89 3	1.73 20	3.27 4	3.54 15	3.09
Control[3]									
Framida	0.91 32	2.72 16	2.51 20	6.37 1	3.06 8	1.54 23	2.57 14	3.15 20	2.68
SE	±0.34	±0.28	±0.33	±0.62	±0.45	±0.24	±0.31	±0.35	
Trial mean (36 entries)	2.38	2.73	3.15	5.33	3.14	1.82	2.49	3.34	
CV (%)	24	17	18	19	24	22	21	18	

1. 6x6 lattice with three replications, plot size ranged from 6.5 to 16 m^2. Numbers following each yield value indicate the ranking of the hybrids.

2. Locations: 1 = Kamboinse, 2 = Farako-Ba in Burkina Faso, 3 = Sapu in Gambia, 4 = Guiring, 5 = Karewa in Cameroon, 6 = Bouake, 7 = Ferkessedougou in Cote d'Ivoire, 8 = Nyankpala in Ghana.

3. Framida is an early maturing variety. The additional three local controls varied according to locations and have not been included in the table.

Table 4. Mean grain yield (t ha-1) of highest yielding early duration varieties in the West African Sorghum Variety Adaptation Trial (WASVAT) at seven locations in West Africa, rainy season 1987[1].

Variety	Farako-Ba	Saria	Sourou	Fada	Samaru	Sapu	Maroua	Mean
Nagawhite	2.81 3	2.90 13	3.08 1	2.07 1	1.48 1	3.58 2	3.68 12	2.80
ICSV 111 IN	2.08 8	3.14 10	1.42 7	1.84 3	0.72 11	2.98 9	5.79 1	2.57
ICSV 1083 BF	2.58 5	3.65 2	1.80 4	1.29 13	1.33 3	2.25 12	4.60 5	2.50
CE 180-33	1.43 16	2.75 16	2.97 2	[illegible]	1.39 2	4.00 1	2.14 20	2.38
S 35	2.47 6	2.77 15	0.86 14	1.69 5	0.50 15	3.04 8	5.30 3	2.37
ICSV 230 IN	3.23 1	3.11 9	2.03 3	1.56 8	0.89 9	2.67 10	2.86 17	2.33
Controls								
ICSH 109 IN	2.97 2	3.80 1	1.33 9	1.46 9	1.02 6	3.42 3	5.25 4	2.75
Local	1.59 13	3.20 7	0.47 16	1.34 11	0.50 15	0.12 14	5.37 2	
SE	±0.38	±0.19	±0.28	±0.21	±0.17	±0.40	±0.62	
Trial mean (20 entries)	2.00	3.07	1.49	1.42	0.94	2.79	3.86	
CV (%)	33	11	33	26	32	25	28	

1. Randomized block design with three replications, plot size ranged from 7.5 to 8 m^2. Numbers following each yield value indicate the ranking of the cultivars.

Table 6. Country, variety, maturity cycle, and number of 5 m rows of seeds being multiplied at ICRISAT's off-season facilities at Samanko, Mali, for the 1991 varietal trials of the West and Central Africa Sorghum Research Network[1].

Country	Variety	Duration[2]	Number of rows multiplied
A. Varietal Trial			
1. Benin	Blanc de Karimana	NI	7
	Blanc de Bagou	NI	7
2. Burkina Faso	83-3/3-1-1	Medium	4
	83-3/48-2-1	Medium	6
	85-12/39-2-1	Medium	8
	85-2/33-1-2	Medium	8
	85-2/53-1-1	Medium	8
3. Central African Republic	Seko	Long	7
4. Ghana	Kadaga	NI	7
5. Guinea (Conakry)	Youlou	NI	7
6. Mali	SCM 388	Medium	7
	CSM 219	Early	7
	Malisor 84-7	Medium	7
	Malisor 84-5	Early	7
7. Niger	BTX 623	NI	7
	BTX 631	NI	7
	BKC	Long	7
8. Nigeria	NR 71158	Medium	8
	NR 71149	Medium	7
	NR 71176	Early	7
	NR 71169	Early	7
9. Senegal	CE 315-14-1-1	Early	8
	CE 145-66	Early	8
	SSV-2	Medium	8

1. NI = Not indicated

Table 7. Varieties and number of 5m rows being multiplied for WCASRN's 1991 disease nursery trial at ICRISAT off-season facilities at Samanko, Mali, and lines received from Cameroon for the 1991 *Striga* trial.

Disease		
Varieties	Number of rows	Lines for *Striga* trial
1. BF 82-7/29-2-1	7	1. CS 54
2. 84 W 3-1	7	2. IS 15823
3. 84 W 849	7	3. CS 61 x Framida
4. BF 83-2/9-2-1	7	4. 82-S-51 x CS 61
5. B 58719	7	5. IS 1260
6. 84 S 82	7	6. S 35 x S 84
7. ICSV 94 BF	7	7. CS 54 x CS 63
8. BF 83-3/52-1-1	7	8. CS 95
9. 84 S 966	7	9. CS-54 x DJIGARI
10. BF 83-3/3-1-1	7	
11. BF 82-7/18-1-2	7	
12. BF 82-7/30-2-1	8	
13. B 58557	8	
14. 84 S 76-1	8	
15. SPV 386	3	
16. 84 W 856	8	
17. 48760	3	
18. BF 83-3/48-2-1	7	
19. ICSV 1003	7	
20. 48887	7	
21 ICSV 23 BF	7	
22. 84 S 89	7	
23. B 58586	7	
24. 84 S 158	7	
25. B 535	7	
26. B 58733	7	
27. E 35-1	7	
28. B 58585	7	
29. 83-3/32-1-1	7	
30. SPV 351	7	
31. 84 S 29	7	
32. BF 82-7/18-2-1	7	
33. BF 83-3/3-2-2	7	
34. 84 S 91	8	
35. ICSV 94-3 BF	8	
36. 84 W 130	7	
37. B 58581	7	

Table 8. Varieties which showed resistance to leaf anthracnose and head bugs during the first year of testing from the WCASRN's projects in Burkina Faso and Mali, respectively, and are being multiplied during the off-season 1989/90, at ICRISAT's facilities at Samanko, Mali.

Project	Variety	Number of rows multiplied (5 m-rows)
A. Leaf anthracnose	1. CSV 655	2
	2. CSV 610	7
	3. ICSV 1049	7
	4. Siripe 1	7
	5. IS 21658	7
	6. CSV 609	7
	7. CSV 600	7
	8. ICSV 2	7
	9. CSV 554	7
	10. Siripe 2	7
	11. CSV 624	7
	12. Frikan	8
	13. IS 9928	8
	14. 84 W 830	8
	15. CSV 660	8
	16. 84 S 130	8
	17. ICSV 1002	8
	18. ICSV 111	8
B. Head bugs	1. IS 21468	7
	2. R 6078	7
	3. M 90318	7
	4. IS 27477	7
	5. B-Var-1	7
	6. CE 151-262-A1	7
	7. TP 21R BO2 107-2-3	7
	8. IS 27329	7
	9. ICSV 1086	7
	10. IS 20740	7
	11. IS 21525	7
	12. IS 22284	7
	13. IS 1637-7	8
	14. IS 27332	7
	15. CSM 388	8
	16. 85 F4 163	8
	17. Malisor 84-7	5

Table 9. Distribution of the more important biotic and abiotic stress factors of sorghum and classification of national program for research purposes according to the prevalence of the stress factor and the manpower capability of the national programs into Lead, Associate, and Technology Adapting Centers.

	Insects		Diseases						Grain			
Country	PAN	BOR	GM	SS	AN	GL	LS	*Striga*	QL	UT	DR	ST
Burkina Faso	A	A	L	A	L	A		A	A			
Cameroon				A	A	A		L			A	A
Mali	L		A	A	A	A	A	A	A		L	A
Niger	A						L		L		A	
Nigeria	A	L	A				A	A		L	A	L
Côte d'Ivoire	A				A	A						
Ghana	A		A									
Bénin												
CAR												
Chad												
Gambia											A	
Guinea												
Guinea Bissau												
Mauritania												
Senegal												
Sierra Leone												
Togo												

1. Stress factors: PAN: panicle, BOR:boreers; GM: grain molds, SS: sooty stripe, AN: leaf and stem anthracnose, GL: gray Leaf spot, LS: Long smut, QL: grain quality, UT: grain utilization, DR: draught, ST: stand establishment. Classification: L: Lead Centers, A: Associate Centers. The others are Technology Adopting Centers.

ANNEXE 1

INFORMATION ON REGIONAL TRIALS

Table 1. Mean grain yield (t ha^{-1}) of highest yielding early duration varieties in the West African Sorghum Variety Adaptation Trial (WASVAT) at five locations in West Africa, rainy season, 1986[1].

	Burkina Faso		Cameroon	Gambia	Ghana	
Variety	Kamboinse	Saria	Guiring	Sapu	Nyankpala	Mean
ICSV 1078 BF	5.58 5	4.16 4	6.75 2	2.82 1	2.01 12	3.66
ICSV 1054 BF	2.68 3	3.55 14	6.70 3	1.96 8	2.73 2	3.52
ICSV 1055 BF	3.07 1	3.98 7	5.63 7	2.09 5	2.07 11	3.37
ICSV 1065 BF	2.08 11	4.31 2	6.07 4	1.56 14	2.41 5	3.28
ICSV 1031 BF	2.00 13	4.10 5	5.65 6	1.91 9	2.4 6	3.21
ICSV 16-5 BF	1.97 14	4.35 1	4.78 14	2.12 4	2.55 3	3.15
Controls						
ICSH-1 (Hybrid)	2.29 9	4.23 3	4.83 12	2.62 2	3.40 1	3.48
Local	0.92 20	3.52 15	6.84 1	1.21 16	-	-
SE	±0.31	±0.36	±0.29	±0.26	±0.31	
Trial mean (20 entries)	2.14	3.67	5.31	1.81	2.00	
CV (%)	25	17	10	26	27	

1. Randomized block design with three replications, plot size ranged from 7.5 to 8.0 m2. Numbers following each yield value indicate the ranking of the varieties.

Table 2. Mean grain yield (t ha^{-1}) of highest yielding medium duration varieties in the West African Sorghum Variety Adaptation Trial (WASVAT) at six locations in West Africa, rainy season, 1986[1].

Variety	Burkina Faso			Cameroon	Gambia	Ghana	
	Kamboinse	Saria	Gampela	Karewa	Sapu	Nyankpala	Mean
ICSV 1063 BF	3.41 6	3.03 9	1.58 11	2.25 4	2.53 1	2.53 2	2.55
IS 915	2.32 19	3.32 5	2.18 1	2.85 1	1.73 15	1.98 6	2.40
ICSV 1074 BF	3.75 1	3.08 8	1.69 7	2.06 6	1.79 14	1.84 12	2.37
PM 11344	2.69 15	3.52 2	1.91 2	1.50 15	2.02 8	2.44 3	2.35
ICSV 1056 BF	3.62 2	3.37 4	1.23 17	1.96 9	2.02 8	1.58 13	2.30
ICSV 1080 BF	3.21 10	3.16 7	1.56 12	1.72 13	2.13 6	1.93 10	2.28
Controls							
ICSH-1 (Hybrid)	3.58 4	2.46 15	1.76 3	2.55 2	2.51 2	2.70 1	2.59
Local	0.85 20	3.23 6	0.69 18	2.05 7	1.47 19	1.53 14	-
SE	±0.38	±0.32	±0.21	±0.39	±0.21	±0.26	
Trial mean (20 entries)	2.96	2.83	1.56	1.87	1.94	1.79	
CV (%)	22	20	24	35	19	25	

1. Randomized block design with three replications, plot size ranged from 7.5 to 8.0 m^2. Numbers following each yield value indicate the ranking of the varieties.

SAFGRAD/OAU-STRC/ICRISAT

WEST AND CENTRAL AFRICA
SORGHUM RESEARCH NETWORK
(WCASRN), B.P. 320, BAMAKO,
MALI

RESEAU OUEST ET CENTRE
AFRICAIN DE RECHERCHE SUR
LE SORGHO (ROCARS)
B.P. 320, BAMAKO, MALI

TECHNICAL INFORMATION BULLETIN
ON PROMISING VARIETIES TESTED
BY THE NETWORK

FICHE TECHNIQUE SUR LES
VARIETES PROMETTEUSES
TESTEES PAR LE RESEAU

NAME OF VARIETY/NOM DE LA VARIETE:

1. ORIGIN/ORIGINE:

2. BOTANIC CLASSIFICATION/
CLASSIFICATION BOTANIQUE:

3. IMPORTANT CHARACTERISTICS/
PRINCIPALES CARACTERISTIQUES:

- Seedling vigor/Vigueur à la levée:
- Photosensitivity/Photosensibilité:
- Cycle, 50% flowering (in days)/
Cycle, 50% floraison (en jours):
- Cycle, at maturity (in days)/
Cycle, à la maturité (en jours):
- Plant height from base of panicle (in cm)/
Hauteur de la plante à partir de la base de
la panicule (en cm):
- Anthocyanin color on leaves/Couleur anthocyanée
sur feuilles:
- Resistance to leaf diseases/
Résistance aux maladies foliaires:
- *Striga*:
- Lodging/Verse:
- Panicle exertion/Exertion paniculaire:
- Panicle form/Type de panicule
- Grain color, size, weight/Couleur des grains,
dimension et poids:
- Acceptance as food/Acceptation gustative:
- Yield (mean from 2 years)/
Rendement (moyenne de 2 ans):
- Rainfall zone/Zone de culture:
- Planting date/Date de semis:
- Resistance to stem insects/
Résistance aux insectes des tiges:
- Resistance to panicle insects/
Résistance aux insectes de la panicule:
- *Testa*:
- Germination % of one year old seed stand establishment/
% de germination d'une semence d'un an à la levée:
- Decortication of yield/Decorticage du rendement:
- Panicle diseases - grain mold/
Maladies de la panicule - moisissure des grains:
- Food quality/Qualité alimentaire:
- Endosperm texture/Texture de l'endosperme:

ANNEXE 2

COLLABORATIVE RESEARCH PROJECTS

WCASRN COLLABORATIVE PROJECT FORMAT

Starting date :_____

Title :

Principal Investigator :

Training Component :

Objectives :

Techniques :

Expected impact of the project :

_____	_____	_____
Coordinator WCASRN	Chairman Steering Committee WCASRN	Principal Investigators
Date _____	_____	_____

FORMAT DU PROJET COLLABORATIF DE RECHERCHE. Date de demarrage: _____

Titre: _____

Chercheur Principal: _____

Elements de formation: _____

Objectif(s): _____

Techniques: _____

Impact escompte du projet: _____

Coordinateur WCASRN	President Comite Directeur WCASRN	Chercheurs Principaux
Date		

WCASRN ANNUAL REPORT

Period : From _____ to _____

Title

Continuing :_____
End :_____

Investigators :

Brief report :

Training : Number of persons :____ % of project resources :_____

Future workplan for next year :

Recommendations of Steering Committee :

Publication :

Coordinator WCASRN	Chairman Steering Committee WCASRN	Principal Investigators

Date :_____

RAPPORT ANNUEL DU RESEAU WCASRN Periode:

Titre Statut :
Fin :

Chercheurs :

Rapport d'activites :

Formation: Nombre de gens : _____ % de ressources du projet:_____

Plan d'action de l'annee prochaine:

Recommendations du Comite Directeur:

Publication:

Coordinateur WCASRN	President Comite Directeur WCASRN	Chercheurs Principaux
Date: _____	_____	_____

USAID/OAU-STRC/SAFGRAD/ICRISAT

FORMULAIRE D'EVALUATION/EVALUATION FORM

PROJETS COLLABORATIFS DE RECHERCHE/COLLABORATIVE RESEARCH PROJECTS

RESEAU OUEST ET CENTRE AFRICAIN DE RECHERCHE SUR LE SORGHO/ WEST AND CENTRAL AFRICAN SORGHUM RESEARCH NETWORK

(WCASRN)

1. Jusqu'ou les objectifs ont ete atteints/To what extent the objectives have been achieved:

2. Quelques commentaires sur les methodes et approches/Comment on the method and general approach :

3. Avez-vous des modifications, recommendations ou suggestions a faire/Briefly mention any modifications, recommendations or suggestions for the future :

4. Comment evaluez-vous le projet en general/Give an overall rating of the project

( ) Excellent
( ) Bon/Good
( ) Moyen/Average

Nom du projet/Name of project _____

Nom du Chercheur principal/Name of Principal Investigator

Nom de l'Evaluateur/Name of Evaluator _____

Date _____

RESEAU OUEST ET CENTRL AFRICAIN DE RECHERCHE SUR LE SORGHO
(WCASRN)

USAID/OUA-STRC/SAFGRAD/ICRISAT
Projets de Collaboration de Recherche

FORMULAIRE DE JUSTIFICATION DES DEPENSES

1. Titre du projet : _____

   _____

2. Chercheur principal : _____

3. Pays : _____

4. Durée du projet : _____

5. Réçus joints _____ Oui _____ Non

6. Détails des dépenses (remplir là où c'est nécessaire)

Poste Budgetaire	Coût en CFA
1. Equipements	
2. Fournitures	
3. Salaires (Technicien)	
4. Salaires (Main d'oeuvre)	
5. Voyage (Hotel, per diem)	
6. Essence	
7. Reparation du véhivule	
8. Reparation de la mobylette	
9.	
10.	
11. Autres (spécifier)	
Dépenses totales	
Montant réçu	
Solde	

7. Signature du chercheur principal _____

8. Nom du Directeur de recherche ou du Chef de la station de recherche _____

9. Signature du Directeur de recherche ou du Chef de la station de recherche _____

10. Date _____

10. Cachet approprié

1991

REGIONAL APPROACH TO SORGHUM IMPROVEMENT IN WEST AND CENTRAL AFRICA

Melville D., THOMAS

AU-SAFGRAD