News and Views

An informal medium for communication

Global Grain Legumes Drought Research Network (GGLDRN)

Volume 1, Number 2 July 1993

From the Editors

Contents

We apologize for the later-than-intended distribution of the first (January 1993) issue of this newsletter. It was inevitable that "gremlins" should disrupt our intentions of timely distribution. Although we cannot claim to have chased all of these gremlins out of the system, we do hope that this and subsequent issues can be despatched on time.

We have established new contacts after the publication of the first issue, and these are listed as an update to the membership directory published earlier. In this issue we feature a note on chickpea yield losses due to low temperature and terminal drought in South Asia. We also include information on drought research on the mandate legumes of some of the International Agricultural Research Centers (IARCs). Suggestions are invited on a proposed brain-storming session on "Management of Agricultural Drought: Genetic and Agronomic Options."

Assembling data bases relevant to drought research and sharing these with network members is proposed to begin in 1994. We are seeking funding for this activity. We now need your input to prepare an inventory of available data bases by filing Form 1 with the coordinator GGLDRN.

An updated membership directory (see News and Views of GGLDRN, Vol. 1 No. 1, page 4) will be published in 1994 based on the information given in the membership directory form we requested you to fill in earlier. The form is reproduced as Form 2 in this issue for the convenience of those who have not yet completed and returned this form.

Editors

News and Views of GGLDRN is published jointly by the International Center for Agricultural Research in the Dry Areas (ICARDA), P.O. Box 5466, Aleppo, Syria; Telex 331208; Fax:963-21-213490; Cable: ICARDA, Aleppo, Syria and International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, A.P. 502 324, India; Telex 422203 ICRI IN; E-Mail:Dialcom 157:CG1505. Fax:+91(842) 241239, Cable: CRISAT, Hyderabad, India. *Editors: N.P. Saxena (ICRISAT/ICARDA), C. Johansen (ICRISAT), and M.C. Saxena (ICARDA).* Contributions should be sent to N.P. Saxena, Coordinator, GGLDRN, Legume Program, ICARDA, P.O. Box 5466, Aleppo, Syria.

Chickpea yield losses in Pakistan and India

In parts of south Asia chickpea was severely affected by low temperature occurring during peak podding stages in the 1992/93 crop season which caused major production losses. A short report from Pakistan and India on this subject highlights the importance of chilling tolerance at reproductive stages in affecting crop yields under the inevitable terminal drought situations.

Pakistan

Chilling temperatures during early pod-filling stages, combined with terminal drought, have severely affected the 1992/93 season chickpea crops in the Thal region, the major chickpea-growing area in Pakistan. An estimated area of 680,000 hectares, representing 70% of total chickpea-growing areas in Pakistan, was planted this year in Thal. Crop losses are estimated to vary between 45 and 80%, depending on the stage of podding at the time of the cold spell. The seed yield losses are estimated at 1023 million in Pakistan rupees. This is the first time such widespread cold damage on chickpea has been observed in Thal.

Chickpea is grown on sand dunes and inter-dunal depressions in Thal, where post-rainy season crops experience rapidly increasing terminal drought and heat, forcing early crop maturity. Sub-zero temperatures in January, when the chickpea crop is generally at the flower initiation stage, are usual in this region with no severe implications for yield, with crop loss estimated at around 5%. In the 1992/93 season, however, the chilling and freezing temperatures occurred again in February (Fig. 1), when the crop was subtending many pods in early seed-filling stages. The cold spell bleached the pods, caused seed abortion and the empty pods desiccated rapidly. The inhibitory effect of low temperature was more drastic in crops planted early in the season, which were in early pod-filling stage rather than in the more advanced crops. Damage was less severe in the irrigated crops and chickpea intercropped with mustard than in the rainfed and sole crop of chickpea. Because of the prevailing terminal drought in this rainfed cropping

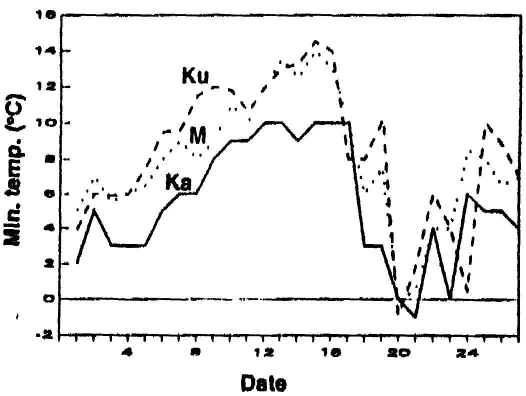

Fig. 1 Minimum temperatures during February at Mianwali (M), Kundian (Ku), and Kallukot (Ka), Pakistan.

system, there was no flowering and podding after the cold spell to compensate for the yield loss. Import of chickpea is essential this year to meet demand and contigency plans have been prepared to increase rainy season production of mung bean and black gram to cover the shortfall in legumes production. (News item based on a survey and tour report. For further information, please contact: *Habib-ur-Rahman Khan* and *B.A. Malik*, Food Legume Improvement Program, National Agricultural Research Center, Pakistan Agriculture Research Council, Islamabad, Pakistan.)

India

The chickpea area in the northwestern state of Rajasthan has been increasing in recent years. On the Jatsar Seed Farm, in Rajasthan, chickpea seed multiplication plots are grown with irrigation on light soils. Three irrigations, including one pre-sowing irrigation, are generally applied. During the 1992/93 crop season, crop losses ranging between 5 and 80% were observed in chickpea due to the occurrence of unusually low minimum temperatures in February, 1993. The area being large (517 ha) sowing was staggered from October 1992 to the third week of November 1992, and hence the crops were at various stages of reproductive growth when the unusual cold spell occurred.

The season was normal until the end of January with minimum temperatures dropping gradually to between 1.5 and 2 °C in the third week of January 1993, with no adverse effect on the crop, which was in the vegetative growth period. Beginning in February, minimum temperatures began to rise but dropped suddenly again between 2 and 3 °C in the third week of February, when the crop was in the reproductive growth stages. Crops sown in October and early November were in peak pod formation and late flowering stages, respectively, while the crop sown in the second and third week of November was in the peak flowering stage.

After the cold spell, pods turned white and seeds inside the pods turned black and died. October-sown crop losses are estimated between 40 and 50%, and around 30% for the early November-sown crop. Damage ranged between 5 and 20% in crops sown between the second and third weeks of November. Maximum damage (around 80%) occurred in the rainfed crop.

Similar damage also occurred in the 1990/91 season. Minimum temperatures had dropped between 1 and 3 °C in the third week of February, when the crop was in peak podding. Interestingly, fields irrigated a few days before the cold spell showed less damage. (*S.D.S. Yadav*, Director-in-charge, Central State Farm, Jatsar, Rajasthan, India.)

Faba beans: a little drought is good for you

After the European soybean crisis of 1973, faba bean attracted attention from 1976 to 1988 as an alternative source of protein (30% protein content). The crop is sensitive to drought, with yields fluctuating between 2 and 8 t/ha, depending on water availability. Irrigation doubles or triples seed yield in field experiments. It was observed in these experiments that treatments of mild drought stress at flowering increased seed yield, compared with no stress treatments. During pod-filling even a mild drought caused severe reduction in seed yield.

In indeterminate faba beans, expanding vegetative organs continue to be a strong sink for assimilates, even during reproductive growth. The crop lacks adaptive mechanisms to drought (e.g., osmotic adjustment), and the continued allocation of assimilates to vegetative structures becomes detrimental to pod-filling. Mild water stress at flowering preferentially inhibits expansive growth of vegetative structures and thereby stimulates pod fill. This advantage is retained for some time even after the mild drought ceases.

Crop management and irrigation practices for improved and stable yield of faba bean were simulated using a simulation model for various soil types. Yields increased by 50% with irrigation after flowering. On a clay soil, the optimum soil moisture content during flowering was 29 vol% and, after flowering, 32%. The model also predicted that doubling the root depth should reduce yield variability by 30%.

Global greenhouse effects (rises in temperature and increases in CO_2 concentration) on the yields of faba bean were also predicted for the year 2030 using the model. An overall increase in productivity is predicted. Increases in rainfed seed yields for Netherlands and Syria are 12 and 68% respectively, while for irrigated crops these are expected to be around 5 and 16% for the same countries. The study suggests that optimizing water supply will remain a major factor for stable yields of drought-sensitive legume crops. (*C. Grashoff*, Centre for Agrobiological Research, P.O. Box 14, 6700 AA Wageningen, Netherlands.)

Towards a common language

Erratum Vol. 1 No. 1 Page 4.

Gremlins also seem to have rearranged the drought classification scheme presented in column 2 from what we intended. It should have read:

Drought escape (completion of life cycle during the period when water is not limiting)

Drought resistance

- Dehydration avoidance (maintenance of tissue turgor and volume), e.g.,
  - maintenance of water uptake through a larger root system
  - reduction of water loss through stomatal control
  - changes in tissue characteristics
- Dehydration tolerance
  - continuance of normal metabolism at reduced protoplasmic turgor

Response to a Common Language

International Institute of Tropical Agriculture (IITA), Nigeria

Drought

"A period of dryness, especially when prolonged, causing extensive damage to crops." This is a good working definition of drought and conveys the meaning to both laymen and scientists.

Drought Resistance/ Tolerance/ Avoidance/ Escape

The above definition of 'drought' indicates that drought is a kind of 'natural calamity' which is either avoided or endured (tolerated) and not an 'organism' or 'enemy' which should be resisted, in addition to being endured or avoided.

In this context, the phrase "Breeding for resistance to drought" does not seem appropriate. In drought-prone areas options available to plants are:

- to avoid (escape) drought by early maturity or deep root systems which follow the receding water table;
- to tolerate (endure) it; or
- to succumb to it.

Therefore, why not use only two terms:

1. ***Drought avoidance***: escape/avoidance of drought by early maturity, deep root system, presence of leaf hairs, waxy coating, etc. Some researchers consider 'escape' different from 'avoidance', but according to Webster's Dictionary they are the same - i.e., running away from the enemy.

2. ***Drought tolerance***: an active physiological response of plants to endure drought, such as by stomatal closure, osmotic adjustment, etc.

The breeding objective should be to combine these attributes in developing drought-avoiding or drought-tolerant genotypes with greater resilience to drought environments. (*B.B. Singh*, Cowpea Breeder, IITA Kano Station, Sabo Bakin, Zuwo Road, P.M. B 3112, Kano, Nigeria.)

National Station for Plant Breeding, Portugal

The group working on drought debated at length one of the points raised in "Towards a common language" and agreed to use the term "moisture deficit" instead of drought. Recently, research on physiological responses of chickpea and peas to water deficit has been inititated, both in terms of escape (phenology) and tolerance, effects on partitioning of assimilates and its impact on yield. This is a collaborative project with LECSA/INRA, Montpellier, France and AFRC/WPBS, Aberystwyth and CSMPP, Sassari. (For further details please contact: *M.M.T. de Sousa*, Head of Department, National Station for Plant Breeding, P.O. Box 6, 7351, Elvas, Codex, Portugal.)

Drought research on legumes at some CGIAR Institutes

International Center for Agricultural Research in the Dry Areas (ICARDA)

Management of drought effects on lentil, kabuli chickpea, vetches, and chicklings is an important area of research in ICARDA's Legume Program. To a limited extent, peas and faba bean also have been studied in order to exploit a range of moisture environments available in West Asia and North Africa (WANA) for growing legumes. Research on chickpea and lentil has been in progress for the last 15 years and feed legumes were added to the Program recently. We have generated information on the inter- and intraspecific differences in drought escape/tolerance. In lentil, drought escape through early maturity has been found to be the most effective way to manage drought. Hence ICARDA has been distributing early maturity nurseries of lentil to cooperators under the International Legume Testing Program. In kabuli chickpeas, we hope to offer nurseries consisting of germplasm and elite breeding genotypes with traits of escape and/or tolerance to drought from the 1994 crop season. Collaboration on basic aspects of drought research with other institutes has been in progress and ICARDA welcomes initiatives from organizations and individuals in this area. (For further information please contact: *M.C. Saxena*, Leader, Legume Program, ICARDA.)

International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)

Nurseries for drought-affected environments

For the ICRISAT mandate legumes, nurseries or trials have been assembled for testing in particular drought-affected environments. These comprise either sets of entries that can escape drought stress due to their shorter duration than standard control genotypes, or sets with entries of a particular duration group and having drought resistance characteristics in relation to control or susceptible genotypes. Those responsible for these nurseries describe the salient features of the nurseries below. For further details and requests for the actual nurseries to be sent for testing, please contact the respective persons.

Groundnut

International Short-duration Groundnut Varietal Trial (ISGVT)

The most promising short-duration groundnut varieties developed by the ICRISAT Legumes Program are included in the International Short-duration Groundnut Varietal Trial. The varieties included in this trial are aimed at areas frequently experiencing end-of-season drought, which thus have a short growing season. These varieties also form an important component of multiple cropping systems in Asia and elsewhere. Currently, we are running V series of ISGVT. This includes 14 test varieties and a short-duration control, Chico, and a slot for a local control cultivar. These varieties are Spanish bunch in growth habit, initiate flowering within about 25 days after sowing (DAS) and mature within about 90 DAS in the rainy season at ICRISAT Center, Patancheru, India. Crop duration extends by 20 to 25 days in the post-rainy season because of low temperatures at the beginning of the season. The varieties in the V ISGVT possess low to moderate levels of resistance to diseases and insect pests, and have medium-sized seeds (30-35 g/100 seeds). The average protein and oil contents are 18-22% and 46-50%, respectively. Seed of V ISGVT can be obtained by a written request to the Principal Scientist (Breeding), Groundnut Breeding Unit, Legumes Program, ICRISAT, Patancheru 502 324, A.P., India. (Contact person: *S.N. Nigam*.)

National and International Drought Nurseries

Groundnut genotypes identified as resistant to mid- and end-of-season drought conditions in experiments at ICRISAT are further evaluated in drought nurseries in collaboration with National Agricultural Research Systems (NARS). In India, a national drought nursery was initiated in 1988 in collaboration with the All India Co-ordinated Research Project on Oilseeds (AICORPO). Results of these evaluations, based on pod yields in a given environment (drought intensity) and further selection of genotypes made on performance across environments, showed that the most promising genotypes were Spanish and Valencia types of 100-110 days crop duration. Five genotypes, i.e., ICGV 86056, 87354, 86187, 86221 and 86106, were identified as higher yielding (18-30%) under drought conditions than the local controls.

So far, we have shared international drought nurseries and trials with 18 countries in Asia, Africa, and the Middle East. However, feedback from our cooperators has been discouraging. These nurseries are potentially valuable in improving understanding of adaptation of groundnut in relation to occurrence of biotic and abiotic constraints, provided a minimum data set is recorded. A second International Drought Tolerance Groundnut Varietal Trial (IDTGVT), comprising 15 test genotypes with a local control genotype, is now being distributed for environments characterized by midseason drought stress. If the trial is conducted in a dry season, midseason drought stress should be imposed for 40 to 50 days from around 40 days after planting. The test entries consist of 10 Spanish bunch, four Valencia, and one Virginia types. The maturity duration of these varieties ranges from 110 to 120 days at ICRISAT Center and other Indian locations during the rainy season. Seeds of II IDTGVT can be obtained from the Principal Scientist (Breeding), Groundnut Breeding Unit, Legumes Program, ICRISAT, Patancheru 502 324, A.P., India. (For further details of criteria used in selecting drought-tolerant genotypes and management of the nursery, please contact: *R.C. Nageswara Rao*, *L.J. Reddy* and *S.N. Nigam*.)

Chickpea

Short-duration Trials/nurseries

Chickpea is grown most often after a rainy season under receding soil moisture conditions. Drought is, therefore, the major abiotic stress for the low yields of rainfed chickpea in the areas of cultivation. However, it is more severe at lower latitudes (<20°) where the evapotranspiration demand is higher than at higher latitudes (25-30°). To ameliorate drought effects, ICRISAT has developed short- to extra-short-duration chickpea genotypes to escape drought effects. Such extra-short-duration genotypes are ICCV 2, ICCV 88202 and ICCV 92504, which mature in 80 to 90 days and have average yields of 1.0 to 1.5 t ha^{-1} in such environments. ICCC 37 and ICCV 10 are promising short-duration varieties.

We offer the following trials/nurseries of short- and extra-short- duration material in 1993:

1. International Chickpea Screening Nursery - Desi extra-short-duration (ICSN-DES)
2. International Chickpea Screening Nursery - Kabuli extra-short-duration (ICSN-KES)
3. International Chickpea Cooperative Trial - Desi short-duration (ICCT-DS)
4. International Chickpea Cooperative Trial - Kabuli short-duration (ICCT-KS)

We are currently supplying these trials and will continue to do so until we exhaust our available seed supplies. (Contact persons: *S.C. Sethi* and *H.A. van Rheenen.*)

International Chickpea Drought Nursery (ICDN)

Estimates of yield losses due to drought range between 20 and >100% in semi-arid tropical India. We have developed field screening methods for selecting chickpea genotypes that can either escape or tolerate drought effects, and have now identified genotypes with contrasting and useful differences in response to drought effects. Promising selections were evaluated in multilocation drought screening trials in collaboration with Indian NARS, based on which an International Chickpea Drought Nursery (ICDN) has been formulated. We are offering this nursery for the first time in the 1993/94 season. The nursery's objectives are:

1. To quantify losses in yield due to drought in particular target environments;
2. To test the efficiency of the drought screening method in a wide range of environments;
3. To confirm previously recorded relative responses of a common set of contrasting genotypes, and
4. To encourage use of the screening method and the genotypic variation so far identified.

The nursery will be useful for identifying promising genotypes for end-of-season drought-prone environments, characterized by a tropical winter that restricts crop growth duration to between 90 and 120 days and with 200 to 250 mm available soil moisture in one meter soil depth. These conditions would favor expression of desirable Genotype x Environment interactions.

Ten genotypes are included in the nursery, with an option to include a well-adapted local control cultivar. Test genotypes include ICCV2 (drought escape), and established drought-resistant genotypes ICC 4958, ICC 10448 and Bheema.

We have begun supplying this nursery and will continue to do so on a first-come first-served basis until we exhaust our limited seed available. We propose a greater seed multiplication in the 1993/94 post-rainy season and hope to serve you better in the 1994/95 season. (For requests of nursery and details of the conduct of the trial, please contact *L. Krishnamurthy.*)

Pigeonpea

Short-duration

A major emphasis in the pigeonpea breeding program at ICRISAT has been to shorten the duration of the crop to fit into various cropping system options, including growing periods delimited by soil moisture availability. As candidates for drought escape we offer:

- Short Duration Pigeonpea International Trial (EPIT), consisting of either determinate (EPIT DT) or indeterminate (EPIT NDT) entries
- Extra-Short Duration Pigeonpea International Trial (EXPIT) with either determinate (EXPIT DT) or indeterminate (EXPIT NDT) entries.

Although environment would influence phenology, it is expected that entries in EPIT would flower around 75 DAS and mature around 120 DAS. In EXPIT, time to flowering would be around 60 DAS and to maturity about 100 DAS. Please note that these genotypes are normally grown as sole crops at high plant density (25-35 plants m^{-2}) and would normally require insecticide protection against pod borers (e.g., *Helicoverpa armigera* and *Maruca testulalis*) (Contact person: *R.P. Ariyanayagam.*)

Drought-resistant lines

Although we do not have any assembled nurseries of drought-resistant lines of pigeonpea for general distribution, we can suggest genotypes that have shown a drought-resistant response in previous drought-screening studies.

In the medium-duration group, screening of several hundred genotypes at ICRISAT Center in the presence and absence of post-rainy season irrigation has identified large genotypic differences in response to terminal drought stress. For example, genotypes such as ICPL 8357 and ICPL 84071 are drought resistant and ICPL 227 and MRG 66 are drought susceptible. In 1987, we conducted a Medium Duration Pigeonpea Drought Adaptation Trial (MDPDAT) for multilocation testing, with NARS collaborators. Results were inconclusive (lack of consistency in ranking across environments), probably due to the overriding effects of other yield-limiting factors, particularly insect damage.

Sets of short- and extra-short-duration pigeonpea genotypes have been evaluated for response to drought stress using line-source sprinklers and rainout shelters at ICRISAT Center. Clear genotypic differences in drought response have been found. For example, indeterminate genotypes generally perform better than determinate genotypes under drought stress. Pigeonpea hybrids show greater drought resistance than comparable varieties, probably due to the greater early growth vigor of both shoots and roots. Among short-duration varieties released for cultivation, ICPL 87 is more drought resistant than ICPL 151, even though the latter is slightly shorter in duration than the former.

Although we do not have any pigeonpea drought nurseries constituted and available for distribution, we are open to requests for seed of genotypes that have displayed drought-resistant characteristics in specific drought environments, subject to availability. We also supply seed of most susceptible types as controls. We are trying to establish an appropriate means of testing adaptation of pigeonpea to drought environments across a range of drought environments. This may lead to development of trial sets for multilocation testing in drought environments. (Contact person: *C. Johansen.*)

Similar but brief information on legume genotypes suitable for testing in drought environments is solicited from readers.

ACIAR/ICRISAT WUE methodology workshop

A collaborative research project on "Selection for water-use efficiency in grain legumes", involving the Australian Centre for International Agricultural Research (ACIAR), the Indian Council of Agricultural Research (ICAR) and ICRISAT began on 1 July 1993 in India. Under this collaborative project, multilocation experiments on groundnut will be conducted at ICRISAT Center and six selected ICAR research institutes in India. The major aim of these experiments is to examine variability in groundnut for water-use efficiency (WUE) and partitioning, and genotype by environment (G x E) interactions for these traits. Some basic studies on WUE in other grain legumes, chickpea and cowpea, will be conducted at the Crop Physiology Department, University of Agricultural Sciences, Bangalore, to examine the relationship between WUE and carbon isotope discrimination. The project activities will be coordinated by the three project leaders, G.C. Wright (ACIAR), M.S. Basu (ICAR) and R.C. Nageswara Rao (ICRISAT).

As a prelude to this project, a methodology workshop on "selection for water-use efficiency and partitioning in groundnut" was held at ICRISAT Center from 5 to 7 May 1993. The objectives of the workshop were:

1. To share information on drought research in groundnut with special reference to water-use efficiency;
2. To facilitate detailed discussions on the proposed experiment on water-use efficiency in groundnut at selected research centers in India (in collaboration with ICAR);
3. To give "hands-on" experience to participants in some methodologies to be used in the project, and
4. To formulate a technical work plan on conducting the multilocational experiments, data collection, analysis and reporting of results.

Over 30 scientists from ACIAR, ICRISAT and ICAR participated in the workshop and exchanged information on drought research in groundnut and water-use efficiency. Utility of carbon isotope discrimination and specific leaf area as indirect measures of WUE in groundnut were discussed in detail. The collaborating scientists had "hands-on" experience with some of the methodology to be used in the project research, e.g., growth analysis, measurement of radiation interception, operation of portable rainout shelters and drip irrigation systems. During the workshop, the collaborators also formulated a technical work plan for the multilocational experiment on groundnut to be conducted during the 1993 rainy season. (*R.C. Nageswara Rao*, Scientist (Physiology), ICRISAT.)

Drought and length of growing season: relationships

A Case Study for Semi-Arid Tropical Myanmar

In ecoregional research and development work, the length of the growing season (LGS) has been given central prominence, since it integrates rainfall with the hydrological qualities of the land and includes water use by crops. LGS is intended for use as a basis for adaptation of crops and for evaluating risks to dependable cropping systems. We wanted to establish the relationship between drought, at various stages of crop growth, and LGS in the semi-arid tropics to predict the agronomic requirements of the adapted land-use system.

We selected the central plateau of Myanmar for this study. It lies within the monsoon realm and has a characteristic wet and dry climate. The rainy season ranges between 3 and 6 months (May to October) during which a total of 700 to 1500 mm rainfall is received. In this unique ecoregion a number of LGS zones can be identified as concentric rings (Fig. 1).

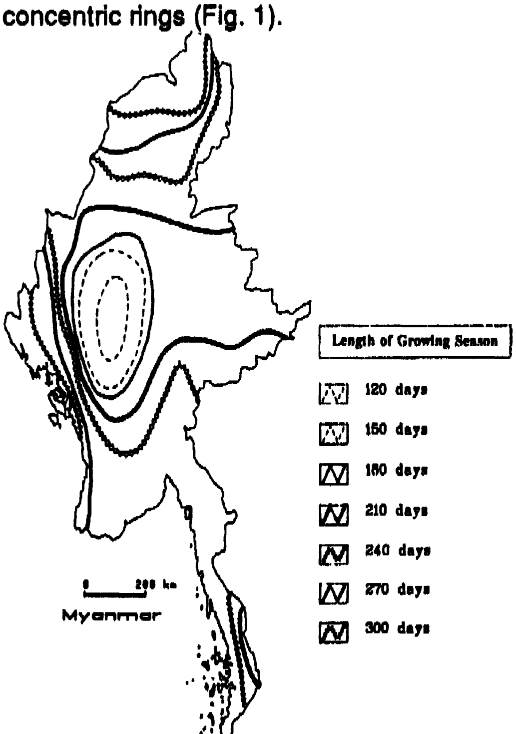

Fig. 1. Length of growing season in Myanmar (Source: Agroclimatology of Asian Grain Legumes, Research Bulletin No. 14, ICRISAT, 1991)

Based on long-term rainfall and soil moisture characteristics, we calculated the probabilities of drought. Frequencies of the adequacies of rainfall to meet potential evapotranspiration needs were estimated by using Markov Chain models; for soil moisture a standard water balance estimator was used. Some preliminary results are given in Table 1.

Table 1.Length of growing season (LGS) and drought at three crop growth stages[1].

	Probability of drought (% of years)		
LGS (days)	Crop establishment	Mid-season	End-season
< 120	30	40	10
120-150	25	30	5
150-180	20	10	5
180-210	20	10	5

[1]Available soil moisture storage capacity=150 mm.

The results show that drought presents a major risk to sustainable crop production at the crop establishment stage across all the LGS zones studied. The risk of midseason drought is relatively high in areas with a LGS of less than 150 days. The end-season drought is not a major concern in the semi-arid tropical areas of Myanmar. The result of this study could form a useful basis for framing agronomic packages of soil and water management practices to alleviate drought-related constraints in central Myanmar. It could also provide guidance for selection and breeding of crop varieties best suited to the probable soil moisture conditions of different regions, e.g., appropriate growth duration and with midseason drought resistance characteristics for LGS of less than 150 days. It could further be used to predict losses due to biotic constraints. As an example, groundnut— a major crop of this ecoregion—is likely to be free of aflatoxin contamination because of the near-absence of end-season drought. (*S.M. Virmani*, Principal Scientist (Agroclimatology), ICRISAT.)

About other organizations

Centre for Legumes in Mediterranean Agriculture (CLIMA)

CLIMA, a new centre for legume research in Australia, was established by the Australian Government in July 1992, as a national cooperative research centre for legumes in mediterranean agriculture. Resources for CLIMA are contributed by the Western Australia Department of Agriculture, the University of Western Australia, CSIRO, and Murdoch University, with each group providing scientists and other resources to operate the Centre. CLIMA is located at the School of Agriculture, University of Western Australia.

The major objectives of CLIMA are:

1. To develop more productive pasture and grain legumes;
2. To enhance the benefits of legumes in increasing soil fertility while minimizing soil degradation, and
3. To achieve better adoption of appropriate new technology resulting from research.

CLIMA's five major programs and subprograms are:

Pastures

Subprogram 1. Adaptation and response to management systems
Subprogram 2. Resistance to pests and diseases
Subprogram 3. Pasture legumes for soils of low pH

Crops

Subprogram 1. Physiological limitations to lupin yield
Subprogram 2. Environmental adaptation of grain legumes
Subprogram 3. Control of grain legume diseases

Soils

Subprogram 1. Increasing nitrogen fixation
Subprogram 2. Cycling of nitrogen in rotations
Subprogram 3. Reducing soil acidification

Modelling

Subprogram 1. Physical and biological modelling
Subprogram 2. Economic modelling

Education and extension

The Crops subprogram 2 (C2) will be of primary interest to GGLDRN participants and is detailed here.

The objective of this subprogram is to develop grain legumes with improved adaptation and greater yield for climatic and edaphic environments of the Mediterranean regions of Australia. Chickpea, faba bean, lentil, vetch, narbon bean and lathyrus (grass pea) will be the legumes studied.

The three main strategies of the C2 subprogram are:

1. To identify the environmental, genetic/physiological and farming system constraints to grain legume adaptation and yield in Mediterranean environments;
2. To expand the genetic base for existing and potential grain legume species, and identify and quantify genotypic variation for adaptive characteristics and commercially useful traits, and
3. To develop germplasm of existing and new grain legumes to the extent where commercial plant improvement programs can be justified.

Linkages with other organizations

CLIMA is developing links with other institutions working in Mediterranean environments. It has already established contacts with both ICARDA and ICRISAT on various aspects of legume research. (*K.H.M. Siddique*, Senior Legume Physiologist/Agronomist, CLIMA/WADA.)

(For further information on CLIMA and its activities please contact: Director, CLIMA, The University of Western Australia, Nedlands WA 6009, AUSTRALIA. Facsimile: (09) 3801140, Telephone: (09) 3802505)

Inventory of drought-related data bases

For developing effective and well-focussed strategies on management of agricultural drought, a precise definition of the target environment in relation to the crop in question is essential. This requires assembling relevant data bases for analysis and synthesis to identify and prepare a priority list of components of the drought complex that needs attention and alleviation, in order to make a meaningful impact on crop performance in drought-prone environments. We solicit your cooperation in these efforts by filling in and returning Form 1.

A beginning was made in this direction at ICRISAT in 1988 with chickpea, pigeonpea and groundnut crops. The objective was to bring together agrometeorolgical and crop data for the purposes of agroecological zonation in Asia, with respect to these three crops. Eleven South Asian NARS participated in a hands-on workshop and the proceedings were published as: Agroclimatology of Asian Grain Legumes, Research Bulletin No. 14, Virmani, S.M., Faris, D.G., and Johansen, C., eds. (1991). International Crops Research Institute for the Semi-Arid Tiopics, Patancheru 502 324, India.

The experience was then extended to West Asia and North Africa in 1991. NARS of 11 important chickpea-growing countries in WANA collaborated with ICARDA/ICRISAT in these efforts and shared information and data bases on crop, climate, soil and occurrence of biotic and abiotic stresses. These were mapped and overlays made using Geographic Information System (GIS) facilities at ICRISAT. This enabled the examination of chickpea production in these areas in relation to the occurrence of various abiotic and biotic constraints. Drought emerged as the most important abiotic stress of spring chickpea in WANA. The outcome of these efforts will be published as a book.

Management of agricultural drought: genetic and agronomic options (proposal for a brain-storming session)

In the last two decades considerable resources have gone into generating new knowledge and information on various aspects of drought research. Perhaps it is time to pause and reflect upon the progress made to date, particularly in practical management and alleviation of problems of agricultural drought. We propose discussing this issue at a brain-storming session. A few topics that we consider important are listed below and we seek your suggestions for improving and enlarging this list.

- A common language (terminology) for reporting drought research.
- Realities of agricultural drought. Assessment of situations that can be managed effectively through agronomy and genetic improvement for making an acceptable impact.
- Listing of legumes suitable for cropping systems in drought-prone areas, and global legume crop research priorities.
- Scope of improvement through agronomic management options in rainfed and partially irrigated (life-saving irrigation) situations; particular advantages of legumes with restricted irrigation option compared with other crops, e.g., cereal in relation to crop water requirement.
- Success/failure in breeding drought-tolerant legume cultivars, their adoption and impact. Where should future emphasis be?
- Short-term (5 years) and medium-term (10 years) goals, thrust areas of research and expected output/impact.

We propose a dialogue on the subject via ICRISAT E-Mail: Dialcom 157:CG1505 system. Depending on the progress we make in preparation for the workshop, we shall plan a date and venue to debate these issues some time in late 1994 or early 1995.

Forthcoming meetings

1993

Dec 4-8 International Symposium of Pulses Research, Kanpur, India. Contact: A.N. Asthana, Directorate of Pulses Research, Kanpur 208 024, India.

Dec 10-12 *Lathyrus sativus* and Human Lathyrism, Progress and Prospects, Dhaka, Bangladesh. Contact: F. Lambein, Lab Physiol. Chem., State University of Ghent, Ledeganckstraat 35, B-9000 Gent, Belgium; or Prof. Anisul Haque, Dept. of Neurology, IPGMR, 1000, Dhaka, Bangladesh.

1994

Feb 21-27 World Soybean Research Conference, Chiang Mai, Thailand. Contact: Ananta Dalaodom, Department of Agricultural Extension, 2143/1 Phaholyotin Road, Chatuchak, Bangkok 10900, Thailand, Tel. +32 9 2645285, Fax +32 9 2645342.

Jul 6-8 Efficiency of Water Use in Crop Plants, University of Reading, U.K. A residential conference organized by AAB Plant Physiology Group. Contact: M.C. Heath, Conference Organizer for AAB, Adas Arthur Rickwood, Mepa, Ely, Cambs, CB6 2BA, Tel. (0354) 692531, Fax (0354)6944885.

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INVENTORY OF AVAILABLE DATA BASES FOR DIFFERENT LEGUME CROPS* - FORM 1

1. Name and address of respondent

2. Particulars of the region for which information is provided (***Use separate forms/photocopies for each region***)

Country ______________________
Name of the region __________ Range of latitude __________, longitude __________, altitude __________
Agroecological zones covered ______________, ______________, ______________, ______________

3. Availability of data bases (***Please list the crops and answer availability of data bases for each by writing Y or N as appropriate***)	Name of major legume crops					Remarks
3.1. Area and production for most recent years: not available (N); available at province (Y1), district (Y2), village (Y3) level	....	....	....	....	....	
3.2. Climatic data for major agroecological zones for the crop duration: not available (N); available daily (Y1), weekly (Y2) or monthly (Y3)						
3.2.1. Precipitation	....	....	....	....	....	
3.2.2. Minimum, maximum or mean temperature	....	....	....	....	....	
3.2.3. Open pan evaporation	....	....	....	....	....	
3.3. Soils data for major agroecological zones: not available (N) or available (Y)						
3.3.1. Soil depth	....	....	....	....	....	
3.3.2. Pedological classification	....	....	....	....	....	
3.3.3. Physicochemical characterization	....	....	....	....	....	
3.4. Maps: not available (N) or available (Y)						
3.4.1. Agricultural atlas	....	....	....	....	....	
3.4.2. Agroecological maps as a hard copy	....	....	....	....	....	
3.4.3. Agroecological maps, digitized	....	....	....	....	....	
3.5. Field survey reports: not available (N) or available (Y)						
3.5.1. Diseases	....	....	....	....	....	
3.5.2. Insect pests	....	....	....	....	....	
3.5.3. Plant stand	....	....	....	....	....	
4. Your assessment of importance of various abiotic stresses in causing yield loss scored on 0-9 scale (where 0 = negligible loss, 3 = <25% yield loss; 5 = <50% yield loss; 7 = <75% yield loss; 9 = crop failure)						
4.1. Drought	....	....	....	....	....	
4.2. Cold	....	....	....	....	....	
4.3. Heat	....	....	....	....	....	
4.4. Other (specify)	....	....	....	....	....	

***Please complete and return to N.P. Saxena, Coordinator, GGLDRN, legume Program, ICARDA, P.O. Box 5466, Aleppo, Syria.**

FORM 2

GGLDRN MEMBERSHIP DIRECTORY INFORMATION*

(PLEASE PRINT ALL INFORMATION IN CAPITALS)

Name ______________________ ______________________
Surname Other names

Address

____

____

____

Position held ______________________________

Highest university degree held ______________________

Specialization and affiliations

Crop(s) ______________________________

Discipline(s) ______________________________

Present designation ______________________________

Institute(s) worked with or for:

Present ______________________________

Past ______________________________

Research interest related to drought ______________________

____

____

____

____

____

____

Phone ______________________ **Signature** ______________________

Telex ______________________

Fascimile ______________________ **Date** ______________________

E-Mail ______________________

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