AVRDC HIGHLIGHTS 1980

TOMATO

The tomato germplasm collection rose by 25 new accessions to a total of 4843. More than 1600 seed packets of elite breeding lines were sent out to 100 scientists in 49 countries.

Hybridization emphasized the incorporation of virus resistance in tomato, following a severe outbreak of virus diseases in 1980. About half the 766 crosses were made with this aim. Another 27 of the crosses were designed to improve processing quality, and 9% to improve fresh market quality.

Fall planting experiments tested ethrel as a means of improving ripening uniformity of processing tomatoes.

The entire collection of tomato germplasm was screened for resistance to rootknot nematode. Some promising examples are to be sent to North Carolina State University for testing against other nematode species.

Seven lines proved highly resistant to rootknot nematode *Meloidogyne incognita* after several screenings. In tests involving various combinations of biological and nonbiological agents, reduced galling resulted when nematicides, chicken manure, and nematode-trapping fungi were used together.

In the summer 594 lines were screened for resistance to bacterial wilt. Five lines proved resistant.

A small number of lines exhibited high resistance to tomato fruitworm in screening trials, and will be retested.

Eight accessions proved tolerant to flooding. As a species, tomato was shown to be far more susceptible to damage from flooding than most other vegetables.

Bangladesh. The Mennonite Central Committee reported that ten AVRDC lines yielded 36 t/ha or more against local checks with 23 and 29 t/ha. Most of the AVRDC lines showed resistance to virus and bacterial wilt.

Guam. The University of Guam has released two AVRDC varieties and named them Lee's Plum and Royal Guam. Both yield more than 60 t/ha and are resistant to disease and fruit cracking. AVRDC is multiplying seed of these varieties for distribution by the University.

India. Two AVRDC selections outperformed local varieties in the Bangalore region. Pathologists at Punjab Agricultural University screened 187 AVRDC breeding lines for resistance to *Septoria*, early and late blights, bacterial pustule, leafcurl and nematodes. Some were selected as potential parents in their breeding program.

Indonesia. After six years of testing, two AVRDC lines were released under the local names Ratna and Intan. Both are wilt resistant and heat tolerant. AVRDC is multiplying seed for the Indonesian authorities.

Malaysia. Only two AVRDC accessions were more resistant than local varieties to the Sarawak strain of bacterial wilt.

Philippines. Six AVRDC entries in trials at the Economic Garden at Los Baños outyielded the check. After three years of advanced yield trials AVRDC materials outyielded local checks in the wet season. During the summer in Bicol Region AVRDC lines outyielded checks by between 150 and 200%. At Claveria Experimental Station nine AVRDC selections gave 42-43 t/ha against 40 t/ha from local check PBI Tm 1.

Taiwan. Taiwan Seed Service released three heat tolerant hybrids resistant to bacterial wilt, to which AVRDC had contributed parent material. AVRDC lines were grown on about 1000 ha (20%) of the area cropped to processing tomatoes in Taiwan during 1980.

Upper Volta. Several AVRDC lines performed well (one giving 59 t/ha marketable yield) against local lines which suffer from severe flowerdrop and very low fruitset.

Zambia. Four AVRDC lines yielded 26 t/ha or more at the National Irrigation Research Station at Mazabuka, against local checks of 13 or 14 t/ha.

USA. An AVRDC variety has become popular with gardeners in the Tucson Arizona, area since a commercial nursery started selling seedlings. In Louisiana several AVRDC entries have been entered in the state breeding program.

Honduras. A home gardening project has identified three AVRDC lines which look promising for the coastal areas.

Virgin Islands. Water Isle Botanical Garden describes AVRDC material as the best they have tested in 30 years and have asked for more varieties to test.

Sri Lanka. One AVRDC line has been released by the Central Agricultural Research Institute (CARI) and other AVRDC lines have been used in CARI's breeding program, which has also resulted in some releases.

Togo. With yields of between 12 and 35 t/ha in trials at Lome, AVRDC varieties have outyielded local checks by almost 5000%.

SWEET POTATO

The sweet potato germplasm collection now numbers 427, with five new accessions received during 1980, and scientists in 15 countries received a total of 324 samples during the year.

Most of the 272 crosses made were designed to improve resistance to weevil and witch's broom.

One hundred and sixty-five lines are under evaluation for storage quality after their roots were found to store well for at least five months.

It appears that the sugar content of sweet potato discourages its adoption as a staple: 122 low sugar lines from the AVRDC collection have been selected for testing. AVRDC sweet potatoes vary from 8%-40% in sugar content.

Ponape. AVRDC yielded between 3 t/ha and 9 t/ha against the local check's 1 t/ha, in spite of an infestation of sweet potato scab.

Solomon Islands Several AVRDC lines will be retested after showing low disease incidence and giving acceptable yields.

Tahiti. In Ministry of Agriculture tests AVRDC lines outyielded local checks, but the orange-fleshed AVRDC sweet potatoes seem not to match local tastes.

Bangladesh. Three AVRDC lines have been selected for further testing after proving consistently better than local varieties in low-management trials held by the Mennonite Central Committee.

Philippines. Seven AVRDC varieties outyielded local lines in trials at Laguna. In other trials, held by the Bureau of Plant Industry, five AVRDC lines outyielded the check. The top two yielders gave 44.4 t/ha and 35.1 t/ha, increases of 216.5% and 172.2% over the check.

Taiwan. AVRDC selection 243-2 yielded 26% more than local check Tainung 17 in trials. Several AVRDC lines gave excellent fall yields, though eating quality and dry matter yields were not exceptional. The genes of these varieties may be useful in breeding programs for high yields.

Thailand. In summer trials at Chiang Mai all AVRDC lines tested gave yields between 27% and 89% higher than the check. All were higher in beta-carotene content.

Surinam. AVRDC lines outyielded local varieties by between 9 t/ha and 13 t/ha but the eating quality was not locally preferred.

SOYBEAN

With 126 new soybean accessions the germplasm collection now totals 9273. During 1980, 67 cooperators in 34 countries received 1448 accessions and 906 breeding lines from AVRDC.

To improve soybean rust resistance, maturation time and protein content, 167 crosses were made. Included in this figure are crosses made at the request of cooperators in Malaysia and Pakistan, to whom AVRDC supplied F_1 seeds.

In advanced yield trials AGS 144 yielded 4.3 t/ha and several others about 4 t/ha: AGS 62 and 66, last year's top yielders, continued to yield well. Five entries in advanced yield trials proved adaptable to all three seasons. Some new accessions also look promising in this respect. All advanced yield trial entries were screened for photoperiod sensitivity.

Experiments on plant density suggest that plants of some soybean varieties can yield as well when grown at 400,000 plants/ha density as at the usual 1,000,000 plants/ha density.

AVRDC evaluated lines released - or on the point of release - by national programs abroad. Center breeders identified higher-yielding lines than these and informed the national programs concerned.

Some new selections yielded up to 14.2 t/ha of vegetable soybean.

Several lines showed resistance to rust, and others to rootknot nematode.

Tests showed that the activities of polyphagous leaf-eating insects have little effect on yields. Two of 1687 lines screened showed resistance to podborers, bringing the total of resistant lines to seven.

Five new insecticides were tested but none proved more effective than AVRDC's standard omethoate. Five accessions were found to be tolerant to beanfly infestation. In spite of damage when insecticides were not used, yields of these five accessions were not significantly affected.

Bangladesh. Yields between 2.7 t/ha and 3.1 t/ha in spring, and between 1.9 t/ha and 2.2 t/ha in summer, were recorded for several AVRDC selections.

India. Under the local name of KM 1, AVRDC's selection G2120 has been released in Tamilnadu State. This is the first AVRDC soybean release to be made by any country.

Indonesia. Soybean G2120 from AVRDC is being multiplied and will be extended to 1000 ha in 1981, with the help of the ROC's Overseas Technical Mission and the Agricultural Development Center in Surabaya, East Java.

Japan. One AVRDC entry gave 4.7 t/ha in 96 days at Okayama Prefectural Experiment Station as against 3.0 t/ha in 91 days by the check variety. In another trial, AVRDC line AGS 17 yielded 5.7 t/ha in 110 days compared to 3.7 t/ha in 96 days by the check. AGS 17 exhibited some problems with tall plants and late maturity.

Nepal. In intercropping trials with corn, AVRDC's AGS 19 yielded 2.5 t/ha in 113 days.

Pakistan. Four AVRDC breeding lines outyielded the local check by about 24% in trials at Tandujam, Sind.

Sri Lanka. Three AVRDC lines outyielded local checks in national program trials. Two of the three gave yields of 4 t/ha each, in 96 and 97 days.

Thailand. Two AVRDC selections outyielded 12 national program selections over nine locations in regional trials.

Guatemala. An AVRDC graduate tested 14 Center selections which had performed well in Taiwan, and obtained yields of up to 1.8 t/ha against less than 1.3 t/ha from the local check.

Honduras. AVRDC's AGS 29 has been released as Darco-1 and is being extended to three regions. It is early maturing, high yielding and resistant to *Cercospora* leafspot.

Nicaragua. AVRDC's AGS 17 was the highest yielding entry in trials at Managua and Rivas. The ROC's Overseas Technical Mission identified it as high yielding, early maturing and disease resistant.

Philippines. In a wet season trial at La Granja Experiment Station the five best AVRDC entries yielded up to 1.77 t/ha as against 1.12 t/ha from the check variety TK 5. In a dry season trial the best three AVRDC entries yielded between 2.23 t/ha and 2.29 t/ha.

Korea. AVRDC's AGS 62 is performing well and maturing early in Korean trials. The national program is to include the line in advanced yield trials. AVRDC scientists helped the Korean soybean breeding program by advancing their breeding lines at the Center. A total of 250 kg of breeding material was supplied to Korea in time for planting.

MUNGBEAN

Thirty more accessions brought the germplasm collection up to 5016. During 1980 scientists in 22 countries received 2761 breeding lines and 1013 accessions from AVRDC. To improve resistance to *Cercospora* leafspot, powdery mildew and lodging, as well as to improve yields, seed quality, photoperiod insensitivity and plant type, 524 crosses were made during the year.

Eleven lines were identified as highly resistant to *Cercospora* leafspot and/or powdery mildew. Nine elite lines were chosen for inclusion in the ninth International Mungbean Nursery.

The mechanism of powdery mildew resistance appears to be polygenic: hybrids are frequently more resistant than parents. AVRDC researchers will attempt to breed for resistance by accumulating resistant genes. Work continued on crossing mungbean and blackgram in the search for resistance to *Cercospora*, mungbean yellow mosaic virus (MYMV), and bruchids.

If one mungbean crop is planted after another, dramatically decreased yields result. This can be avoided by crop rotation. The problem appears to be a root disease complex caused by the interaction between living

organisms involving *Pythium* sp, *Fusarium* sp, *Rhizoctonia solani* and high populations of renniform nematodes.

AVRDC once again coordinated the International Mungbean Nursery. In the vast majority of cases, except in India and Pakistan, AVRDC cultivars outyielded the best local varieties.

Analysis shows that with every 10^{0} of latitude from the Equator, mungbean's days-to-flowering increases by 6.8 days and yields drop by 300 kg/ha.

Forty AVRDC breeding lines and 22 accessions resistant to *Cercospora* leafspot and/or powdery mildew were sent to researchers in Asian countries. National programs in 22 countries received a total of 100 breeding lines.

After two field tests, 29 accessions were rated highly resistant to rootknot nematode, and 26 moderately resistant.

Out of 60 crop combinations tested, only one showed promise for beanfly control. Depodding tests showed that yield reduction is not significant after damage by podfeeding insects. Two accessions of blackgram were highly resistant to bruchid attack. Pod pubescence is the possible reason in one case. Both lines will be used for breeding bruchid resistance into mungbean.

Korea. An AVRDC accession from the Philippines was released in southern Korea under the local name Bangasa. Another AVRDC line outyielded two local checks by an average of 20% at eight locations. The line is insensitive to long day conditions, but a lodging problem must be overcome before it can be released.

Taiwan. In a regional trial in Tainan County one AVRDC line yielded 1.72 t/ha, between 35% and 72% more than local varieties. The Korean release Bangasa also performed well and Tainan DAIS is to recommend both to Taiwan's seed board committee in 1981.

Philippines. Three AVRDC lines tested at the Los Baños Economic Garden will be tested in farmers' fields. Forty of 100 AVRDC lines were selected for further testing at Los Baños. The Philippines Atomic Energy Commission reports that one AVRDC line yielded 2.91 t/ha and another 2.71 t/ha against 1.65 t/ha from the local check.

Bangladesh. Five of 16 AVRDC lines tested at Joydebpur and Jamalpur performed well in spite of MYMV infestation and gave 1.16 - 1.60 t/ha against 0.72 t/ha from the local check at Joydebpur. Yields at Jamalpur were generally lower. The Mennonite Central Committee reports that at Char Bata two AVRDC lines outyielded local checks by 75%, one of them yielding 1.57 t/ha. Both were more resistant to MYMV.

Fiji. One AVRDC line has performed well for the second year and

another appears highly resistant to powdery mildew.

Somalia. Two Center lines yielded 1.91 t/ha and 1.63 t/ha respectively against the best local check of 0.63 t/ha. Both were resistant to *Cercospora* leafspot. Researchers in Somalia have asked for more seed.

Zambia. One AVRDC line planted on 4 ha is reported high yielding and favored by local people for its cooking quality.

Tanzania. In trials, three of 246 AVRDC lines were free of *Cercospora*; one was free of powdery mildew and 24 others were highly resistant to it; seven had only trace infections of mungbean scab; and 16 were resistant to bacterial leafspot.

CHINESE CABBAGE

The germplasm collection of Chinese cabbage now totals 750 with 52 new accessions arriving in 1980. The size of seed samples from the Center was increased and 690 packets sent out.

Work was stepped up into cytoplasmic male sterility (CMS) as a hybrid breeding tool. CMS does not break down under high temperatures as self-incompatibility tends to do. Backcrossing, designed to improve turnip mosaic virus (TuMV) resistance of heat tolerant lines, continued. Seven heat tolerant and TuMV resistant lines will be further backcrossed.

Of 42 heat tolerant inbred lines tested for resistance to softrot, TuMV and downy mildew, 16 were selected for further tests and inbreeding. Nine showed some level of resistance to all three diseases. In trials of 12 high yielding lines, Hybrids 58, 59 and 62 continued to give the best yields.

Only one of 28 accessions showed promise for resistance to cabbage webworm. Only one of five lines maintained resistance to diamondback moth. Twenty-five of 585 accessions of Chinese cabbage show tolerance to flooding and have been selected for field tests.

Several insecticides performed as well as parathion, and EPN especially seemed promising.

More than 150 scientists from 15 nations took part in the world's first international symposium on Chinese cabbage, organized by AVRDC and held in March/April 1980 in Tsukuba, Japan.

Indonesia. The Horticulture Research Institute selected six AVRDC entries for advanced trials.

Korea. Two hybrids, each with AVRDC germplasm as one parent, are being released to seed companies after highly successful yield trials by the Center's Korea Outreach Program. Called Wonkyo 202 and Wonkyo 203, the hybrids gave average yields of 28.1 t/ha and 44.7 t/ha respectively at four different locations.

Malaysia. AVRDC materials showed heading rates of 89-98%. Malaysian scientists continued advanced testing of some AVRDC lines.

Philippines. In wet season trials by the Bureau of Agricultural Extension, one AVRDC line yielded 22.2 t/ha against 15.9 t/ha from the local check. In trials at Mount Banahaw in Quezon Province two other Center lines gave the highest yields of 17 t/ha, against 7 t/ha from the local check. The Bureau of Plant Industry (BPI) identified four AVRDC cultivars with some resistance to softrot.

Thailand. AVRDC Hybrids 30 (LV) and 58 yielded about 12 t/ha each at trials near Bangkok, or four times the local check. Semi-commercial planting of AVRDC hybrids is to start in Thailand in 1981.

Taiwan. Lun Yang Cooperative Farm near Chiayi planted AVRDC Hybrids 58 and 62 and had good results. The farm plans to plant 30-40 ha to AVRDC hybrids next year.

NUTRITION, ENVIRONMENT AND MANAGEMENT

Twenty varieties of soybean were compared for suitability for commercial tofu-making. The color of soybean sheet powder is an indicator of a variety's tofu-making quality.

Sweet potato crosses were made in the search for low sugar lines, more acceptable as a staple. A positive correlation was found to exist between low sugar and high dry matter contents, and a less marked one between low sugar and high protein.

AVRDC took on a full-time nutritionist for a two-year program to examine nutrition needs in southeast Asia and to plan - and possibly implement - a program involving the role of vegetables in the Asian diet. Initial dialogues have been started with two programs in the Philippines and one in Indonesia.

An AVRDC agricultural economist and a senior plant breeder participated in a survey preparatory to the first Asian Development Bank project on vegetable crops, to be staged in the Philippines. The project will probably serve as an outlet for AVRDC varieties and technologies since Chinese cabbage, mungbean, tomato and sweet potato were recommended for planting at the project location.

A social anthropologist has joined the Center and will be examining farming systems in Taiwan in relation to agricultural labor shortages, especially where such systems involve one of AVRDC's crops. Data is being gathered also for the Taiwan Appropriate Technology Survey launched during 1980, which seeks to catalogue small scale farming technologies in Taiwan which may be relevant to less developed countries.

A Japanese seedling culture using smoked rice hull and nutrient solution was tried successfully with tomato and Chinese cabbage. A mono-

lith-type soil sampler has been developed at AVRDC capable of taking samples from hard ground without undue disturbance of the field.

Trials showed that a 10 cm within-row spacing, and a 25 cm between-row spacing, resulted in the best yields from mungbean planted at 400,000 plants/ha. For soybean, the best spacings (with two plants per hill) were 10 cm within rows and 50 cm between rows in spring and 10 x 25 cm in fall. The best marketable yields of Chinese cabbage during the summer were achieved at 25 cm within-row spacing and 30 cm between rows.

For mungbean, the critical period of weed competition was between 30 and 60 days after planting (DAP). In the case of soybean, significant yield loss resulted in spring trials if weed competition went on beyond 60 days after sowing (DAS): in fall trials the critical period had started at 45 DAS. Large tomato yield losses resulted if weeding was stopped at 14 days in late fall trials in 1979 but not in spring 1980. On weed-infested tomato treatments the critical period for competition began at 42 days after transplanting (DAT) in 1979 and 28 DAT in 1980: this difference is probably due to differences in the weed population.

Drought stress imposed at 30-40 DAP increased root size of sweet potato, especially if irrigated regularly after this point. Soil compaction trials on sweet potato in pots showed that the optimum soil density for high root yields was 1.3-1.5 gm/cc.

Direct seeding of Chinese cabbage, as opposed to transplanting, could give up to 27 higher total yield and 53 higher marketable yields, earlier maturity and larger head size.

During 1980 agricultural economists at AVRDC prepared and submitted a draft research proposal to survey vegetable marketing in Sri Lanka, which received encouragement in Sri Lankan government and university circles. The full proposal will be completed in 1981.

Mycorrhiza has improved the growth of maize, mungbean, soybean, tomato and sweet potato in the greenhouse. With mungbean in the field, mycorrhiza treatments promoted better uptake of nutrients, particularly phosphorus.

SEED LABORATORY

The seed laboratory multiplied a total of 6582 accessions during the year and distributed 30,415 seed packets. Almost 18,000 went overseas to 84 different countries and territories. The single largest recipient of AVRDC seed was Taiwan, with Korea and Thailand next.

Multiplying Chinese cabbage, as the only cross-pollinated crop under study at AVRDC, continued to give problems, though the use of honeybees for pollination instead of human labor has improved random pollination and podset and has saved labor.

Work on the hard seed problem of mungbean - which interferes with

germination and cooking - shows that black-seeded and small-seeded varieties tend to produce more hard seed. Varieties with large coffee-colored or green seeds tend to produce fewer hard seeds.

TRAINING AND DEVELOPMENT

During 1980 44 participants from 13 countries completed their training at AVRDC. These included production trainees, special purpose trainees, research scholars, summer student trainees, and research interns. The cumulative total of trainees to have passed through AVRDC by the end of 1980 was 273 from 25 countries.

Results of the Development Program's cooperative field tests show that farmers in two locations have high preference for two new promising soybean lines owing to their high yield performances. However, merchants pay higher prices for lines with better beancurd-making qualities.

1980 was an extraordinarily dry and hot year. This affected heat tolerant Center tomato lines which grew vegetatively and exhibited poor fruitsetting and hence low yield.

During the autumn season the production trainees' field evaluation of two cultural practices using two promising tomato lines showed that using AVRDC-developed practices resulted in 30% higher yield and larger fruit size.

INFORMATION SERVICES

More than 3400 people in 141 countries now regularly receive AVRDC publications, with the addition of 774 names in 1980. The list was fully computerized.

A new news magazine named CENTERPOINT was launched and sent quarterly to everyone on the mailing list.

Eighteen news releases were despatched during 1980 and a large number of personal contacts established with the press. Greatly increased radio and press coverage resulted. About 7000 visitors from all over the world toured AVRDC during the year.

Two all-Chinese exhibitions, one in Taichung and one at National Taiwan University in Taipei, were organized by OIS.

A campaign to persuade companies to offer AVRDC favorable terms on goods and services resulted in savings totalling about US$1500.