INTERCROPPING in semi-arid areas

Report of a symposium held at the Faculty of Agriculture, Forestry and Veterinary Science, University of Dar es Salaam, Morogoro, Tanzania, 10-12 May 1976

Editors:
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Intercropping in Semi-Arid Areas

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Farmer’s field near Ibadan, Nigeria, showing intercrop of cowpea under maize.
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Intercropping with Sorghum at Alemaya, Ethiopia

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In Ethiopia, sorghum, which is the second most important food crop after tef, is grown both at high altitudes along with such cereals as wheat, barley, and tef, and at low altitudes where virtually no other crop thrives. In the high altitude areas, sorghums are seldom grown in pure stands but in mixtures with other crops. The most important area of highland sorghum areas in Ethiopia is the Chercher Highlands in the eastern part of the country, where sorghums are grown in mixture with maize (*Zea mays* L.), chat (*Catha edulis*), beans, and sweet potatoes, the most common combination of crops being sorghum–maize–beans (23, 24). At planting time the typical farmer mixes sorghum and maize seeds in equal proportion by volume and to this mixture he adds one-fourth of the mixture volume of beans. The entire mixture is broadcast over the prepared seed bed and covered using either an oxen plough or a shovel-like hoe. Since the sorghum seed is much smaller than either the maize or bean seeds, this typical mixture of seeds gives a higher proportion of sorghum plants. The maize crop is normally harvested green in the soft- to hard-dough stage of seed formation and consumed or marketed as maize on the cob. The maize stalks are also removed while still green and fed to livestock. The beans are also normally pulled long before the sorghum is cut, thus giving the sorghum plants much wider space after seed formation for good panicle and seed development.

Farmers in the Chercher Highlands attribute several advantages to mixed cropping as compared to pure stands of the component crops. Through mixed cropping the farmer is provided with food for his family and feed for his livestock over a longer period of time compared to a pure culture. In the mixture mentioned above, the maize is normally consumed first, then the beans, and finally the sorghum. This system of farming also provides a sort of insurance against poor harvests. If the rains are optimum all the three crops develop sequentially and complementarily but if the rains are below normal the farmer pulls out the appropriate component of the mixture to fit the seasonal rainfall situation. The mixture also provides the farmer’s family with more balanced nutrition, and such cropping also enables the farmer to spread his family labour more efficiently. The beans mixed with the cereals must also help in maintaining soil fertility. This advantage is specially noteworthy because the application of fertilizers in field crops is seldom practiced in the Chercher Highlands. Pest and disease prevalence must be minimized under mixed cropping rather than under pure culture of a single crop. Under these mixed cropping systems the stratifications of plant heights and foliage densities at various heights certainly help minimize soil erosion. Last, but not least, farmers feel that they get higher economic returns through mixed farming.

Alemaya is a typical place in the Chercher Highlands where highland sorghums dominate the agriculture of the region and mixed cropping is the stan-
standard practice of the average farmer. The altitude is about 2000 m and the annual rainfall is about 860 mm, coming in a bimodally distributed pattern with the small rains peaking in April and the big rains reaching the highest level in August. Planting is normally done toward the middle of April with harvest at the end of December. This means the crop season for sorghum is as long as 9 months. With the bimodal distribution of the rains, some farmers pull out the beans that have been planted at the beginning of the small rains and put in another crop of beans at the beginning of the big rains in July. This planting of the second bean crop often coincides with the cultivation of the maize and the sorghum.

The objectives of the experiments at Alemaya were to ascertain to what extent the advantages attributed to crop mixtures in the Chercher Highlands were true or not. An additional objective of the investigation was to determine the optimum combination of crops to give the highest economic return under a peasant farming system of the Ethiopian sorghum highlands. It was also the intention of this investigation to compare early and late-maturing sorghum varieties for their fitness in an intercropping system.

The trials conducted in 1974 involved three sorghum cultivars, one from each of the late, intermediate, and early maturity group of sorghums for Alemaya, and two different species of legumes, a haricot bean cultivar and a local cowpea. Another intercropping experiment in 1975, at the same location, involved the two late and intermediate sorghum cultivars and the haricot bean used in the 1974 trial, an early maturing maize, and a standard soybean cultivar.

The 1974 trial showed that the late sorghum cultivar, Alemaya 70, and the intercropped haricot bean cultivar Ethiopia 10 gave a total yield of 58 q/ha compared to 50 q/ha for the best pure stand of sorghum and 20 q/ha for the highest yielding legume pure stand. The highest yields were realized when both the sorghum and the bean were planted simultaneously early in the crop season. In 1975, the highest grain yield of 80 q/ha was obtained with the pure stand of Katumani maize when planted early. The best yield from an intercropped plot, 58 q/ha, was again obtained from Alemaya 70 and Ethiopia 10 with early planting of both the sorghum and the bean. This compared with 38 q/ha for the best pure stand of sorghum, Alemaya 70. Pure stand of Ethiopia 10 gave only 20 q/ha of bean yield as in 1974.

The overall results of the two years show that although the economic advantage of intercropping over a sole crop was not impressive, the best combination of intercropping in the Chercher Highlands appears to be to use a late-maturing sorghum and an early maturing legume (having neither a spreading nor aggressive habit), both planted early.