Production and Management

Survey of *Masakwa* Sorghum Growing Areas in Northeastern Nigeria

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Introduction

Masakwa sorghum is a postrainy season sorghum that is grown on an estimated 102,564 km^2 mainly in the Lake Chad Basin area of Borno State, northeastern Nigeria. Similar types of sorghum can be found on extensive areas in neighboring Cameroon and Chad. There is little rainfall during this season and the crop is grown on residual soil moisture. Although this cold-tolerant crop is an important cereal in Borno State, very little information is available on the local germplasm and production practices and constraints.

The soils on which *masakwa* sorghum is grown are developed on Chad lagoonal clays underlain by aeolian sands and on alluvium of the Bama Fluvial/Deltaic complex. The pedons at Ngala and New Marte in Borno State are Typic Pellustarts, while at Bama and Gwoza they arc Vertic Ostifluvents. Calcium carbonate, manganese, and iron manganese concretions are common in these soils.

The soils are moderately to very highly base-saturated but are very low in organic carbon and nitrogen (Mordi et al. 1991).

The climate of Borno State is characterized by two distinct seasons, the wet and the dry seasons. The wet season lasts from June to September in the northern parts, and May to Oct in the southern parts of the State. The average annual temperature is about 30 °C with a maximum of 45 °C in March/April and a minimum of 15 °C during the dry Harmattan season when *masakwa* sorghum is grown.

The main objectives of the survey were to determine the *masakwa* sorghum production practices to identify the major constraints to production, and to collect local germplasm of *masakwa.* Baseline information is needed to focus research efforts on this crop.

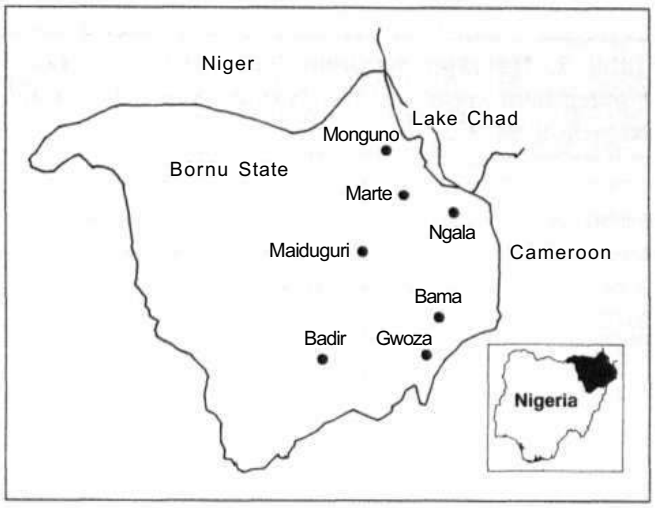

Figure 1. Local government areas surveyed in northeastern Nigeria.

Methodology

The survey areas were selected for their differences in agriculture, geography, and accessibility. Twenty four villages in 17 local government areas (LGAs) of Borno State were visited (Fig. 1). The survey was conducted using structured questionnaires which served as a check list. Discussions were held with farmers in about eight farms per village. Sorghum heads were collected from some farms.

Cultural practices of *Masakwa* sorghum production

Table 1 shows the major *masakwa* sorghum types grown in Borno State. The common types grown across the three zones are Burugukhime (red grain), Bulwalana (white grain), Adjagama (cream grain), and Tumbuna (milk grain). Based on their relative popularity in the communities and their marketability, cultivars can be ranked in decreasing order of preference as follows: Bulwalana, Adjagama, Tumbuna, and Burugukhime. However, in Bama LGA, Burugukgime was the most-preferred cultivar.

Farmers select sites for *masakwa* sorghum production on the basis of soil types, availability of land, and the amount of water stored during the wet season. Sandy clay loam to clay soils are most commonly used. Land is prepared manually, between February and May, using local implements such as cutlasses and hoes. The land is cleared of trees and shrubs. Dykes/bunds of about 0.5 to 0.75 m are constructed on the farm with the aim of impounding rainwater (which otherwise may run off), and

Table 1. *Masakwa* **sorghum types grown in Local Government** areas **and villages/towns in Borno State, Nigeria, 1991/92.**

Local Government Area	Village/Town	*Masakwa* sorghum, predominant types
Ngala	Ngala	Bulwalana
	Bugda	Burugukhime
	Dagala	Tumbuna
	Dikwa	Adjagama
Monguno	Mashillo	Bulwalana
	Njinne	Tumbuna
	Old Marte	Adjagama
		Burugukhime
Bama	Iza	Burugukhime
	Arikarari	Tumbuna
	Keri, Mbaga	Adjagama
	Walasaloderi	Adjagama
	Jagoriri	Adjagama
	Vialiya	Adjagama
	Maimiliri	Burugukhime
	Mbuliya	Burugukhime
	Banki	Burugukhime
Gwoza		
	Ngige	Adjagama
	Doric	Burugukhime
	Gwoza	Tumbuna
		Burugukhime

increasing infiltration. During early September, the new weeds that emerge are cleared and burned.

The major source of seeds is the previous seasons' harvest; secondary sources are government agencies (research institutes and agricultural development programs), and local markets. In most cases farmers raise their own seedlings, but some farmers purchase seedlings from other farmers. No farmer is engaged solely in the production of *masakwa* sorghum seedlings for sale. The nurseries are prepared in August after the heavy rains have subsided. Farmers use sunken nursery beds ranging in size from 1 x 1 m to 3 x 3 m, and usually broadcast their seeds. Seedlings are ready for transplanting about 30 to 40 days after sowing. They are uprooted from the nursery beds and tied up in small bundles which are placed in an upright position in shallow pools of water for 1 to 2 days to stimulate the development of new roots. The tops of the seedlings' leaves are cut to reduce transpiration, while their roots are trimmed with a sharp knife to facilitate transplanting. *Masakwa* sorghum is established by transplanting 4- to 5- week-old seedlings into 15 - 20 cm deep holes made manually with a heavy wooden dibbler (called - *gabgal* in Kanuri). About 200 mL of water is poured into each transplanting hole before 1 to 2 seedlings of *masakwa* sorghum are inserted. Akpose et al. (1996) reported that *masakwa* sorghum can also be direct seeded, provided irrigation facilities are available. This method of sowing and the resultant crop performance warrants further investigation.

Generally, farmers use about 10,000 plants ha"[1] but where the soil moisture status is high, especially on very heavy soils, a population of about 20,000 plants ha^{-1} **is** used. The local cultivars sown by farmers take 110 to 150 days to mature, and during this period no chemical fertilizer is used. An average yield of 800 kg ha^{-1} is recorded in farmers' fields.

Biotic constraints

The major pests of *masakwa* sorghum are birds, grasshoppers, and stem borers of the genus *Sesamia.* Birds are the most important yield-reducing agents. They attack mostly Bulwalana, Adjagama, and Tumbuna types while Burugukhime (red grain type) is rarely attacked, probably because it contains tannin. There are no cheap improved methods of controlling these pests. Farmers employ such traditional bird-scaring techniques as bird scaring by people perched on high wooden stands. They also harvest the crop early, at physiological maturity, to minimize bird damage. Covered smut *Sporisorium sorghi* (Ehrenberg) Link, downy mildew *Perenosclerospora sorghi* (Weston and Uppal) C.G. Shaw, and unidentified viruses are the common diseases. Farmers do not use measures to control these pests.

None of the farmers in the *masakwa* sorghum growing areas uses herbicides for weed control. They weed manually, using simple tools, mostly hoes and cutlasses. Weeding is done up to three times after transplanting depending on the degree of infestation. Generally, there were more weed problems in Bama and Gwoza LGAs than in the other areas surveyed.

Labor constraints

There are two main sources of farm labor: family and hired. There are, on average, four family members per household available for farm work in the areas surveyed. Hired labor is the most important source of farm labor and is mostly used for land clearing (i.e., cutting shrubs and grasses), for bunding, making holes for seedlings,

transplanting, and harvesting. At transplanting the cost of hiring labor in all the areas surveyed varied between ₦50 (US$1 - 12₦ 1991) and ₦70 per person day. In areas where labor costs are low, farmers tend to establish more farm units or, bigger farms than in areas where labor costs are high.

Yield performance of *masakwa* sorghum

The yield performance of *masakwa* sorghum in four LGAs of Borno State is shown in Table 2. In Ngala LGA Adjagama gave the highest grain yield (909 kg ha^{-1}), followed by Burugukhime (687 kg ha^{-1}), while Bulwalana recorded the lowest yield (398 kg ha^{-1}). Tumbuna had the highest grain yields of 1393 kg ha^{-1} in Mongun LGA and 947 kg ha^{-1} in Bama LGA. In Gwoza LGA, Bulwalana had the highest grain yield of 786 kg ha^{-1} followed by Adjagama (699 kg ha^{1}). Burugukhime recorded the lowest grain yield at 649 kg ha^{-1}.

Cultivars seemed adapted to particular locations. Seed size was large and varied little among cultivars. Low plant densities, while minimizing interplant competition for water, placed a low ceiling on potential yields.

Table 2. Grain yields and yield components of Masakwa sorghum types in four local government areas (LGA) of Borno State, Nigeria 1991/92.

	Grain yield (kg ha^{-1})	Seeds $panicle^{-1}$	100-grain mass (g)
Ngala			
Adjagama	909	2605	4.4
Burugukhime	687	3689	4.1
Tumbuna	616	2293	3.8
Bulwalana	398	1739	4.2
Monguno			
Tumbuna	1393	2496	4.1
Bulwalana	749	2798	4.9
Burugukhime	660	2021	4.1
Bama			
Tumbuna	947	2706	5.0
Adjagama	892	2456	4.8
Bulwalana	838	1853	5.5
Burugukhime	822	2288	4.4
Gwoza			
Bulwalana	786	1929	5.6
Adjagama	699	2765	5.0
Burugukhime	649	1906	5.0

Research needs

There is a need to understand how efficiently this crop uses soil moisture and the scope to increase crop density or duration. Current transplanting methods are laborious and costly and the feasibility of direct seeding is worth further study. Labor savings will result in a larger area being cultivated. Appropriate bird control measures need to be developed. The profitability of alternatives to *masakwa* sorghum cultivation should also be examined. With appropriate land management rainy season soybean or postrainy season chickpea may be potential alternatives.

Acknowledgment

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Influence of Nitrogen on Seed Production of Sorghum Hybrids

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The possibilities of using nitrogen manipulation to increase sorghum hybrid seed production through improved synchronization of flowering between male and female parents have been explored by earlier breeders (Basavaraju and Bommegowda 1982, Reddy et al. 1992, Gayatri 1993).