

INDIGENOUS BREAD WHEAT VARIETIES FROM NORTHERN NIGERIA

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SUMMARY

The indigenous bread wheats from Northern Nigeria are described. They mainly belong to var. *erythrospermum* and var. *meridionale*. The Nigerian wheats are very susceptible to mildew. They belong to a group of Ne_1^m -carriers, the Sudan zone perhaps forming an Ne_1^m -region. These wheats may have come from the Near East, through Egypt. Later, a second wave of non-carrier Sahara wheats may have broken the link between the Near East and the Sudan zone.

Some varieties are morphologically different (var. *graecum*) and carry the Ne_1^m -allele. They derive possibly from wheats introduced from India/Pakistan.

1. INTRODUCTION

1.1. Introduction of wheat

Bread wheat, *Triticum vulgare* L. and durum wheat, *T. durum* Desf. are commonly cultivated in Africa. Especially durum wheat is grown in North Africa, while bread wheat is raised in the Sahara oases, the Sudan zone, Ethiopia and North Africa and more 'recently' in East Africa and South Africa. Bread wheat plants are found also as admixtures in durum fields in North Africa (BOEUF 1932; ERROUX 1972) and Ethiopia (ANDERSON 1961). Other *Triticum* species have been found in Ethiopia and Mauretania.

It is assumed that wheat and barley as well as their cultivation have been introduced from the Near East by way of Egypt in the very early Neolithic. This introduction would then have been effected by immigrant Neolithic peoples settling in Egypt among the local food gatherers and hunters of the Terminal Paleolithic about 5000-4000 B.C. (WENDORF et al. 1970). From Egypt wheat spread westward and southward during the Makalian wet phase (6000-3000 B.C.) (CLARK 1962).

A second route of introduction may run through Arabia to Ethiopia across the Red Sea (MURDOCK 1959, 1960). The route is surmised because of the morphological similarities of the wheats of Yemen and Ethiopia, and because "Egyptian" crops are not cultivated in Nubia, the link between Egypt and Ethiopia. It may have been used to introduce tetraploid wheats with possible admixtures.

The hexaploid bread wheats of the Sahara and the Sudan can indeed have come by way of Egypt. This conclusion is supported by the agricultural practices of Egyptian and Hausa/Sourai farmers (CHEVALIER 1932) which bear a similarity there.

It is not known when and how bread wheat reached Northern Nigeria. It is probably a very old crop.

The spread of wheat in Africa north of the Equator as pictured by MURDOCK (1959) is "impressionistic" only (G. P. MURDOCK, pers. comm. 1970).

1.2. Cultivation and trade

Wheat is cultivated in Northern Nigeria as a wet-season crop and as an irrigated dry-season crop (DALZIEL 1937). It is often grown on bunds between beds and on the edges of irrigation channels. In Chad small beds of 1 to 2 m² are used (A. DOBOS, pers. comm. 1972). The indigenous varieties ripen in about 50–55 days. The yield is quite low (ANDREWS 1968).

Wheat is traded on the local market. Formerly it was regarded as a rich man's crop (BARTH 1857; HOLLAND 1922; ANDREWS 1968). BARTH (1857), for instance, stated that throughout the Central Sudan zone wheat was considered the prize dish of Arab princes. Owing to the import of wheat flour, the spread of wheat cultivation, the introduction of improved varieties like Pusa wheats, To(u)sson, Florence-Aurore, and nowadays of Sonora 63 (ANDREWS 1968), extension work and the increasing number of bakers more people of the area eat bread at present.

1.3. Species and botanical varieties

CHEVALIER (1912) stated that all wheats of the Sahara and south of it belong to *T. durum* var. *leucurum* Alef. This is not so. The wheats of the Sahara belong to *T. vulgare* (DUCCELLIER 1920) and so do the wheats of the Sudan zones (CHEVALIER 1932). The misidentification was caused by the apparent morphological similarity of the Sudan zone wheats and *T. durum*. Chevalier's misidentification was copied by HOLLAND (1922), DALZIEL (1937), SCHNELL (1957) and probably several others.

According to CHEVALIER (1932) the wheat populations are rather uniform and mixtures are rarely cultivated. The Sudan zone wheats do not belong to the so-called *oasicolum* type described by DUCCELLIER (1920), which is common in the oases of the Sahara. This may point to a different origin for both populations.

The land variety of wheat (Blé du Pays) Haoussa (syn. Blé de Bamba, no. 2, Blé de Tombouctou) described by CHEVALIER (1932) refers to a variety from Mali. HOLLAND (1922) described the wheats of Katsina and Zaria as bearded *T. vulgare*. The same type was found in Bammaka, Sudan zone (probably Bamako, Mali). According to Holland the same race may occur over a wide area extending northwards to the Sahara. One sample was received in 1921 of a beardless wheat. This variety may derive from a recent introduction, because wheats had been introduced since 1910 (HOLLAND 1922). DALZIEL (1937) found *T. durum* var. *leucurum* to be common in Northern Nigeria. In the Katsina area *T. vulgare* var. *leucurum* is cultivated. Dalziel's *leucurum-durum* should be transferred to *T. vulgare* var. *graecum*.

ANDREWS (1968) described the Nigerian wheats as 90–100 cm long, having weak straw, bearded, early maturing (50–55 days), flinty, red, humped grains

and susceptible to diseases. The yielding capacity is quite high. No other descriptions of Northern Nigerian local wheats are available. For neighbouring Chad ERROUX (1954) described var. *erythropermum* as the common variety.

2. MATERIAL STUDIED

Mr. D. J. Andrews of the Institute for Agricultural Research, Samaru, Zaria, Northern Nigeria kindly made 50 samples of Nigerian wheat available. Of these 15 came from Katsina area, 23 from the Wurno (Sokoto) area, 4 from the Hadejia area, 4 from Zaria, 3 from the Daura area, and one sample from Northern Nigeria. Forty-five samples from the Dikwa area were obtained through Mr. L. B. Olugbemi of the same institute. From the World Grain Collection at Beltsville, Maryland, USA came sample PI 201768 from Northern Nigeria. The two samples from Northern Nigeria originally came from the Maiduguri area. This area is close to the Hadejia and the samples have been incorporated in the Hadejia samples.

Several wheat samples of Katsina consisted of red and white grains. According to ANDREWS (pers. comm., 1969) these red grains belong to Nigerian local wheats, while the white grains will be the (at that time) recommended variety Tousson.

The samples arrived in Wageningen in 1969. They were grouped into accessions with red grains, white grains, and mixture. The white grains of the last accessions were separated and named Katsina-Wit etc.

The varieties have been grown at the fields of the Instituut voor Plantenveredeling since that time.

3. OBSERVATIONS AND CONCLUSIONS

3.1. Colour of grain at arrival

The numbers of accessions per group of grain colour and per area are given in *table 1*. Conspicuous are the high percentages of white-grained accessions and mixtures of red and white grains from Katsina. As suggested (in Material Studied), this was caused by the growing of white-grained introduced varieties.

Table 1. Number and percentages of accessions with red (R), white (W) or red + white grains.

Area	R	%	W	%	R+W	%	Total
Daura	1	(33)	1	(33)	1	(33)	3
Dikwa	42	93			3	7	45
Hadejia incl. "N. Nigeria"	6	100					6
Katsina	8	53	2	13	5	33	15
Wurno	22	96	1	4			23
Zaria	4	100					4
Total	83	86	4	4	9	9	96

3.2. Botanical varieties

At first sight the various accessions are very similar, if not identical. They are all bearded and have white glumes at maturity. A closer look shows that some accessions are mixtures of plants with pubescent or glabrous glumes. No attempt has been made to establish the frequencies of these two characters.

Table 2 presents the classification of the accessions. The dominant variety is var. *erythrospermum* with 25 pure and 50 mixed accessions. The second is var. *meridionale* with 13 pure and 50 mixed accessions. It may be significant that the accessions from the Katsina area include a high percentage of glabrous ones, while those from the Dikwa area are mixtures of plants with pubescent and glabrous glumes. The accessions from Wurno appear to be pure like those from the Katsina and Zaria areas. On p.143 it is shown that the white-grained accessions (var. *graecum*) may derive from wheats introduced into Nigeria from N.W.British India since 1910. In addition to these wheats there are five accessions which completely differ from the general picture of Nigerian wheats. They are Daura 3, Dikwa 1, Dikwa 34, Katsina-Wit 37, and Wurno 2. Daura 3 and Dikwa 1 belong to var. *lutescens*. They are identical to cv. Florence-Aurore. Dikwa 34 belongs to var. *erythrospermum*. It resembles a bearded version of Florence-Aurore. Katsina-Wit 7 consists of plants belonging to either var. *graecum* or var. *hostianum*. The first three accessions are probably introduced from Tunisia. The fourth accession could have originated from hybridization of a Nigerian and an exotic wheat. Wurno 2, var. *erythrospermum*, resembles varieties obtained from Morocco.

3.3. Plant height

The average plant height from plants of the described accessions grown at Wageningen is about 50–55 cm, which makes them much smaller than the plants grown in Nigeria (see chapter 1.3). This difference must have been caused by the

Table 2. Number of accessions classified into botanical varieties.

Area	Botanical varieties							Total
	1	2	1+2	3	4	3+4	5	
Daura	1			2			1 ¹	4
Dikwa	1 ²		43			3	1 ³	48
Hadejia incl. Nigeria	3	1	2					6
Katsina	12		1	6		1 ⁴		20
Wurno	6 ⁵	12	4	1				23
Zaria	2			2				4
Total	25	13	50	11		4	2	105

1 = var. *erythrospermum*

2 = var. *meridionale*

3 = var. *graecum*

4 = var. *hostianum*

5 = var. *lutescens*

¹ Daura 3

² Dikwa 34

³ Dikwa 1

⁴ Katsina-Wit 7

⁵ including Wurno 2

change in growing conditions. The occurrence of a heavy attack of mildew may also have retarded their development.

The white-grained accessions are somewhat taller than the red-grained accessions. Whether this is caused by a slightly lower susceptibility to mildew or by a different genotype for plant height has not been investigated (see below, however).

3.4. Disease susceptibility

All accessions are very susceptible to the mildew strain or strains occurring in the Netherlands. Especially the red-grained accessions are covered by mildew mycelia. The white-grained accessions appear to be somewhat less susceptible to mildew. This suggests that the white-grained accessions belong to a population different from the red-grained accessions and that they are not merely white- and red-grained plants of one population (see below).

Owing to the heavy mildew attack no observations about other diseases could be made.

3.5. Genotypes for hybrid necrosis

Hybrid necrosis is conditioned by two complementary alleles Ne_1 and Ne_2 (HERMSEN 1957). HERMSEN (1963) found multiple alleles at both Ne_1 - and Ne_2 -locus. ZEVEN (1966, 1971) demonstrated that these alleles have a particular geographical distribution over the Old World. Northern Nigeria belongs to an Ne_1 -area.

Several of the Nigerian accessions have been tested for their Ne -genotype. The results are given in *table 3*. As expected no Ne_2 -carriers have been found in Northern Nigeria. Forty-four of the 53 accessions are Ne_1 -carriers while 3 are impure for Ne_1 and ne_1 . This makes Northern Nigeria an Ne_1 -area. Hence these

Table 3. The frequency of Ne_1^m , Ne_1^w and non-carriers of Nigerian wheats.

Area	Ne_1^m *	Ne_1^w	$Ne_1^m + ne_1$	$Ne_1^w + ne_1$	ne_1	Ne_2	total
Daura	1						1
Daura-Wit			1				1
Dikwa	26		1		3		30
Dikwa-Wit	1	1		1			3
Hadejia incl. Nigeria	2						2
Katsina	7						7
Katsina-Wit		5			1		6
Wurno					1		1
Wurno-Wit					1		1
Zaria	1						1
Total	38	6	2	1	6	0	53

* the haploid genotypes are $Ne_1^m = Ne_1^m ne_2$, $Ne_1^w = Ne_1^w ne_2$, $Ne_2 = ne_1 Ne_2$, $ne_1 = ne_1 ne_2$ = non-carrier-accession; $Ne_1^m + ne_1$ are mixtures of $Ne_1^m ne_2$ and $ne_1 ne_2$. m = moderate, w = weak.



DAURA 1

DIKWA 26



KATSINA-WIT 6

DAURA 3

Fig. 1. Ears of four Northern Nigerian wheat varieties. Daura 1 (var. *erythrospermum*) and Dikwa 26 (var. *meridionale*) are typical Northern Nigerian; Katsina-Wit 6 (var. *graecum*) is probably introduced from India/Pakistan and Daura 3 (var. *lutescens*) resembles the North African cv. Florence-Aurore.

wheats are completely different from the oasis-wheats, which are mainly non-carriers (ZEVEN 1971). In addition to the difference in morphology the difference in Ne-genotype points to a different development.

Thirty-eight of the accessions are Ne₁^m-carriers while 2 are impure for Ne₁^m and ne₁. It is striking that 38 of these 40 accessions are red-grained while only two are white-grained. Seven Ne₁^w-carriers were detected, all belonging to white-grained accessions. This also suggests a different provenance of the red-grained and white-grained accessions.

ZEVEN (1971) has shown that three Ne₁^w-areas exist in the Old World. One is situated in Italy-Southern France-Northern Spain-Northern Portugal, the second in N.W. India-Southern Pakistan-Eastern Iran. The third area, identified by a weaker Ne₁^w-allele than the Ne₁^w-alleles of the first two regions, lies in China.

The fact that the Nigerian Ne₁^w-carriers are white-grained and differ in other characters from the red-grained accessions indicates the likelihood of a derivation from introduced British Indian (Pusa) wheats.

Zeven (1971) established the existence of an Ne₁^m-region in Northern Nigeria. Results of future research may show the Sudan zone to be on the whole an Ne₁^m-region. This is very probable because of the similarity of Nigerian and Chad wheats and some accessions from Mali (unpublished observations) and because some wheats of the present Sudan are Ne₁^m-carriers (ZEVEN 1971). This Ne₁^m-region perhaps links to a second Ne₁^m-area which lies in Turkey-Caucasus-Kazakhstan-Omsk district-Turkmenia-Uzbekistan-possibly NW. Iran-northern part of Saudi Arabia. No data are yet available about the southern part of Saudi Arabia (ZEVEN 1971).

If the Ne₁^m-carrying wheats from Northern Nigeria and possibly from other parts of the Sudan zone were taken by man from the Near East by way of Egypt it must have been done before a second wave of new, non-carrying wheats were introduced into the Sahara.

ACKNOWLEDGEMENTS

I am extremely grateful to Mr. D. J. Andrews and Mr. L. B. Olugbemi of the Institute for Agricultural Research, Samaru, Zaria, Nigeria for sending me the wheat samples and to Mr. J. S. de Block for correcting the English text.

REFERENCES

- ANDERSON, E. (1961): The analysis of variation in cultivated plants with special references to introgression. *Euphytica* 10: 79-86.
- ANDREWS, D. J. (1968): Wheat cultivation and research in Nigeria. *Niger. agric. J.* 5: 67-72.
- BARTH, H. (1857): *Travels and discoveries in North and Central Africa*. Pt. II. 57. New York. Cited from R. L. HESS (1965): The itinerary of Benjamin of Tudela: a twelve-century Jewish description of North-East Africa. *J. Afric. Hist.* 6: 15-24.
- BOEUF, F. (1932): Le blé en Tunisie. I. La plante. Le milieu physiochimique. *Ann. Serv. Bot. et Agron. de Tunisie* 8: 4+454. *Plant Breeding Abstracts* 3 (1933) no. 193.
- CHEVALIER, A. (1912): Énumération des plantes cultivées par les indigènes en Afrique tropicale VII. *Bull. Soc. Nat. Acclim. de France* 59: 386-392.

- CHEVALIER, A. (1932): Les productions végétales du Sahara et ses confins Nord et Sud, passé, présent, avenir. *Rev. Bot. Appl. et d'Agric. trop.* **12**: 669–814 (Ch. 3: les céréales des régions subsahariennes et des oases: 742–749).
- CLARK, J. D. (1962): The spread of food production in sub-saharan Africa. *J. Agric. Hist.* **3**: 211–228.
- DALZIEL, J. M. (1937): *The useful plants of West Tropical Africa*. London, 612 pp.
- DUCELLIER, L. (1920): *Les blés du Sahara*. Alger.
- ERROUX J. (1954): Les blés du Fessan. *Bull. Soc. Hist. Nat. Afrique Nord* **45**: 302–317.
- (1972): Blés indigènes nord-africains. *Plant Genetic Resources Newsletter* no. **28**. August: 17–23.
- HERMSEN, J. G. TH. (1957): Semi-lethality in hybrid offspring of wheat. *Euphytica* **6**: 18–25.
- (1963): Hybrid necrosis as a problem for the wheat breeder. *Euphytica* **12**: 1–16.
- HOLLAND, J. H. (1922): The useful plants of Nigeria. Bull. Misc. Inform. Addit. Series IX. *The useful plants of Nigeria*. Pt. **4**. London. 963 pp.
- MURDOCK, G. P. (1959): *Africa, its peoples and their culture history*. McGraw-Hill Book Comp. Inc. 456 pp.
- (1960): Staple subsistence crops in Africa. *Geogr. Rev.* **50**: 523–540.
- SCHNELL, R. (1957): *Plantes alimentaires et vie agricoles de l'Afrique Noire*. Paris 223 pp.
- WENDORF, F., R. SAID & R. SCHILD (1970): Egyptian history: some new concepts. *Science* **169**: 1161–1171.
- ZEVEN, A. C. (1966): Geographical distribution of genes causing hybrid necrosis in wheat. *Euphytica* **15**: 281–284.
- (1971): Fifth supplementary list of wheat varieties classified according to their genotype for hybrid necrosis and geographical distribution of Ne-genes. *Euphytica* **20**: 239–254.