Potentials of organic sesame production in humid tropical africa

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Abstract

The development and release of improved and high yielding sesame varieties can fast track the drive to meet the increasing global demand for certified organic sesame. Sixteen varieties of sesame (E-8 (Check), NCRIBEN-01M, NCRIBEN-02M, NCRIBEN-03L, PBTil, Domu, ABBS, 530-6-1, Cameroon white, CIANO-16, CIANO-27, Pachequeno, Kwandere, Eva, Adakuawari and CROSS-95) were evaluated for their yield performance under organic system in 2010 – 2012. The grain yield of all the test varieties were greater than the world average (490 kg ha^{-1}), except Cameroon white and Domu when growing conditions were favourable in 2010 and 2011. However, under less favourable growing conditions of 2012, only Kwandere, Adakuawari, CIANO-27, ABBS, 530-6-1, PBTil, NCRIBEN-02M and E-8 recorded grain yield above world average. It is therefore, recommended that Kwandere, Adakuawari, CIANO-27 and NCRIBEN-02M be advanced to the farmers for large scale production alongside the varieties already with them.

Introduction

Sesame (*Sesamum indicum* L.) is an old oilseed crop grown mainly for its seed which contains approximately 50% oil and 25% protein (Burden 2005). There is an increasing global demand for organic sesame because of the growing health consciousness and high nutritional qualities of sesame seeds as excellent source of food, edible oil and bio-medicine (WIKIPEDIA, 2012). The potential of organic sesame has been grossly underutilized hitherto in Africa even though the continent is naturally endowed with climate favorable for sesame cultivation (Olowe et al. 2009). Unfortunately, the current world average yield of sesame still remains low at 0.49 t ha $^{-1}$ as against 5.5 t ha $^{-1}$ recorded as average composite yield in the European Union (FAO 2012). Therefore, this study was carried out to evaluate the yield performance of recently released and some newly acquired accessions of sesame under organic system with a view to recommending those with high yield potential for cultivation.

Material and methods

The three year field studies were conducted on the research plots of the Organic Agriculture Projects in Tertiary Institutions in Nigeria (OAPTIN) situated at the Teaching and Research farm of the Federal University of Agriculture, Abeokuta (7^o 15´ N, 3^o 25´ E, 140 m.a.b.s.l) during the late cropping season (July – November) of 2010, 2011 and 2012. A total of fourteen and fifteen varieties were evaluated in 2010 and 2011, and 2012, respectively and their details were as follows: E-8 (Check), recently released (NRICBEN-01M, NCRIBEN-02M and NCRIBEN-03L), available with farmers (PBTil, Domu, ABBS, and 530-6-1), and recently acquired accessions (Cameroon white, CIANO-16, CIANO-27, Pachequeno, Kwandere, Eva, Adakuawari and CROSS-95). The test varieties were sown at a spacing of 60 x 5 cm in a randomized complete block design and replicated twice in 2010 and 2011. However, in 2012, a split plot design was used in which Fertilizer application (F0 – no fertilizer and F1 – organic fertilizer applied) was assigned to the main plot and the 15 test accessions to the sub plot. Organic fertilizer (Aleshinloye Fertilizer - 1.2%N, 76 ppm P, 13.75 cmol K, 10.28 cmol Na) was applied at the rate of 50 tonnes ha^{-1} equivalent to 60 kg N.ha^{-1} of the inorganic fertilizer recommended for conventional sesame (Olowe and Busari, 2000). Data were collected on number of branches and capsules per plant and weight of seeds and capsules per plant, 1000 seed weight and grain yield on plot basis. All data collected were subjected to analysis of variance and where significant, means were separated using the least significant difference method.

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Results

Growing conditions were more favourable during the late cropping season in 2010 and 2011 because rainfall distribution was relatively better (2010 - 791.2 mm and 2011 - 934.0 mm) than 2012 with 415.4 mm. As such, a combined analysis of variance was conducted on the data for 2010 and 2011. Mean values of grain yield and some yield attributes averaged over 2010 and 2011 are presented in Table 1 and the main effects means of these traits, and variety by fertilizer interaction effect on grain yield in Table 2. The test accessions were significantly ($p<0.05$) different for weight of capsules and seeds per plant in 2010 – 2012 (Tables 1 and 2) and 1000 seed weight in 2010 - 2011 (Table 1). Eight (including E-8, Check) out of the fourteen accessions recorded 1000 seed weight lower than 3.0 g in 2010 and 2011. Whereas, only 530-6-1, CROSS 95 and Kwandere recorded values greater than 3.0 g in 2012 under dry growing conditions. Varietal and variety by fertilizer interaction effects significantly (*p<0.05; F-test*) affected grain yield of the test varieties in 2012.

Discussion

According to Day (2000) and Burden (2005), sesame premium seed qualities include colour (white-pearly white), size (1000 seed weight ≥ 3.0 g) oil content (40 – 50%) and moisture content (< 6%). All the accessions in our study had pearly-white seed colour. Six out of 14 of the test accessions recorded 1000 seed weight ≥ 3.0 g in 2010 – 2011. Whereas, three varieties out of 15 recorded values ≥ 3.0 g under dry growing conditions in 2012. Under more favouarble conditions in 2010 and 2011, all the accessions recorded grain yield higher than the world average of 490 kg ha^{-1} (FAO 2012), except Cameroon white and Domu. However, when growth conditions were less favourable in 2012, the accessions produced lower grain yield under control (176.5 – 343.5 kg ha^{-1}) relative to applied organic fertilizer (432.5 - 732.6 kg ha^{-1}). This indicates that application of organic fertilizer enhanced the yield performance of these accessions and thus confirmed their potential in the region.

Suggestions to tackle the future challenges of organic sesame production

Future efforts should be geared towards developing new and improved sesame varieties with the potential of producing high seed yield using organic agriculture best practices. This is quest is being driven by the steady increase in demand for organic sesame in the world market.

Table 1: Grain yield and some yield attributes of fourteen sesame accessions (means of 2010 and 2011)

Varieties	No[a]. of branches	No[a]. of capsules	Wt[b]. of capsules **(g)**	Wt[b].of seeds **(g)**	1000 **SeedWt[b] (g)**	Grain **Yield (kg/ha)**
E-8 (Check)	4.2	30.8	12.1	2.66	2.8	589.9
NCRIBEN-02M	2.7	24.6	9.73	2.41	3.4	533.1
Cameroon white	3.3	18.8	7.5	1.61	2.5	347.9
PBTil	4.6	39.8	15.4	4.59	2.7	984.2
530-6-1	2.9	37.1	21.1	4.93	3.2	1066.0
ABBS	3.4	31.3	11.2	2.91	2.5	627.5
CIANO-16	3.1	25.9	11.9	3.94	1.7	825.2
Adakuawari	3.6	38.6	14.4	3.93	2.6	883.7
NCRIBEN-03L	4.2	46.8	14.4	4.29	3.0	914.9
CIANO-27	3.8	34.6	13.7	4.36	2.6	928.0
Pachequena	4.2	38.3	13.5	4.07	2.8	845.0
Domu	2.8	27.9	8.7	1.80	3.0	398.0
Kwandere	3.4	21.5	10.2	2.17	3.2	455.0
Eva	3.1	26.2	10.8	2.84	3.4	616.8
lsd (0.05)	ns	ns	6.16	2.32	0.44	ns

ns: not significant
[a] No: number
[b]Wt: weight

Table 2: Main effect means of grain yield and some yield attributes, and the fertilizer X variety interaction effect on grain yield of fifteen sesame accessions in 2012

Varieties	No[a]. of branches	No[a]. of capsules	Wt[b]. of capsules	Wt[b]. of Seeds (g)	1000 SeedWt[b] (g)	Grain Yield ($kg.ha^{-1}$) 2012	Grain yield ($kg.ha^{-1}$) F0[c]	F1[d]
E-8 (Check)	1.9	23.8	10.3	1.47	2.90	494.7	314.9	674.4
NCRIBEN-02M	1.8	14.7	7.6	1.22	2.96	488.9	245.3	732.6
Cameroon white	2.8	9.5	5.0	0.78	2.81	284.6	188.5	380.6
PBTil	2.8	10.5	4.8	0.92	2.50	394.9	216.8	572.9
530-6-1	2.8	11.5	7.4	1.13	3.01	440.9	250.6	631.1
ABBS	2.0	17.0	7.2	1.21	2.99	384.2	179.2	589.2
CIANO-16	2.3	8.3	5.2	0.78	2.95	281.1	237.8	324.5
Adakuawari	2.2	12.2	5.6	1.03	2.92	390.5	248.1	532.8
CIANO-27	2.7	9.7	4.8	0.98	2.91	403.2	216.6	589.8
Pachequena	2.2	10.2	4.4	0.70	2.80	252.7	179.9	325.4
NCRIBEN-03L	2.0	15.0	6.4	0.89	2.75	384.3	343.5	425.3
Eva	2.0	10.0	5.9	0.98	2.87	360.5	278.4	442.9
NCRIBEN-01M	2.3	10.0	4.7	0.71	2.94	302.3	214.3	390.3
Cross 95	2.2	8.0	3.5	0.57	3.08	301.9	176.5	427.4
Kwandere	2.2	12.5	9.4	1.27	3.14	451.9	339.5	564.5
lsd (0.05)	Ns	5.48	2.58	0.37	ns	109.64	155.06	

ns: not significant
[a] No: number
[b]Wt: weight
[c]F0: No organic fertilizer
[d]F1: Organic fertilizer

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