U. of K. J. Agric. Sci. 23(1), 89-98, 2015

Production Potential and Some Agronomic Practices of Bambara Groundnut *(Vigna subterrenea* L). Verdc*)* Under Rainfed Conditions of South Gedarif Area

Ibrahim Elsadig Ibrahim[1], Ali ElToum Hassan[1], Jamal Elkhair[2]

[1]Gedarif Research Station, Sudan
[2]Hudeiba Research Station, Sudan

Abstract: Field experiments were executed for two successive seasons (2009 and 2010), at the southern area of Gedarif State with the objective of studying the influence of sowing date and population density on the productivity of a land race Bambara groundnut. Four sowing dates, viz., 27th of June, 9th, 19th and 27th of July and five combinations of inter-row*intra-row spacings, 40cmx30cm, 40x20, 30x30, 30x20 and 20x20, were used during both seasons. The data recorded in both seasons were plant height, canopy width, 100 seed weight, shelling % and pod yield ton/ha. Results revealed highly significant differences in most of measured parameters with respect to sowing date. Early sowing resulted in a significantly higher pod yield (4.3 ton/ha) when compared to late sowings (i.e. 2.3, 1.3 and 0.94 ton/ha for 9th, 19th and 27th of July, respectively). Variable plant spacing significantly affected pod yield during the first season, while no significant variation was observed during the second season. Nevertheless, higher yields were obtained with wider spacings. Accordingly, the early sowing from late June to early July is suggested as optimum sowing date for Bambara groundnut with row-crop spacings of 40-30cm inter-row and 30-20cm intra-row for the rain fed conditions of south Gedarif area.

Key words: Bambara groundnut, sowing date, population density

INTRODUCTION

Cultivated crops reached 6000 species, used for a variety of purposes. Only few crops contribute to the majority of the world food supply. On the other hand, many crops have significant contribution to the world food

security, yet they have not received the attention they deserve. Accordingly, Bambara groundnut *(Vigna subterrenea* L). Verdc*)* is among these neglected crops, although it is the third most important food legume in Africa after cowpea (*Vigna unguiculata*) and peanut (*Arachis hypogeal* L). It has many uses as food, animal feed, soil conditioner and as a medicine. The total world production of Bambara groundnut reached 217-240 thousand tons of which 45-50% comes from West Africa. Although Bambara groundnut represents an important source of food and income for the people in the area, the crop has not captured researcher's attention yet. Since the main goal of agricultural research is to improve the productivity of the main crops as well as other crops that may have the potential to contribute to food security or used as cash crops, Bambara groundnut was given attention as one of the most promising crops.

The yields obtained by the famers of the Gedarif area are considerably low (0.5-0.8 t/ha) when compared to 2-3 t/ha in the research centers (Akonaay and Maige, 1982; Smyth, 1968). The farmers grow this crop using narrow spacing (20cm as inter row and 20cm as intra row spacing) resulting in a very dense crop.

This study intends to improve the productivity of Bambara groundnut. It investigates two of the most important agronomic practices affecting the productivity; i.e. sowing date and population density.

MATERIAL AND METHODS

Two experiments were carried out at Doka demonstration farm, during 2009 and 2010 growing seasons. Doka site is 75 km south east of Gedarif town (latitude 13° 44′ N, longitude 35° 77′ E, and elevation 604 m above sea level). The soil of this site is heavy cracking clays (Vertisols), with very low organic matter (0.58%) and low nitrogen content (0.027%,). Soil physical and chemical characteristics of the experimental site are presented in Table 1.

In both seasons, four sowing dates (S_1, S_2 , S_3, and S_4), were executed at 27^{th} of June, 9^{th}, 19^{th} and 27^{th} of July with five population densities,

viz., P_1, P_2 , P_3 , P_4 and P_5 using five combinations of inter-row and intra-row spacing (40cmx30cm, 40x20, 30x30, 30x20 and 20x20, respectively).The treatments were arranged in a factorial RCBD with three replications. The seeds were obtained from local farmers at Kisayba village. Land preparation was done as recommended. The crop was sown manually. After establishment weeding was carried out whenever necessary during the two seasons. At harvest pod yield, 100 seed weight and shelling percentage, plant height and canopy width were recorded.

Table 1. Soil Chemical and Physical Characteristics of Doka experimental site

Character	Value
Clay content (%)	76
Silt content %	22
Fine sand content (%)	1.0
Coarse sand content (%)	1.0
Bulk density (g /cm^3)	1.7
Porosity (%)	36
pH	7.4
Calcium carbonate (%)	7.4
Carbon/nitrogen C/N (%)	8.8
Total nitrogen (%)	0.021
Organic carbon (%)	0.58
Available phosphorus (mg/kg soil)	4.0

Statistical analysis was carried out using MSTATIC package. The treatment means were compared using least significant difference (LSD).

RESULTS AND DISCUSSION

Doka site received total rain-fall of about (441mm) during 2009 and received higher rain-fall (777mm) during 2010 (Table 2). It was well observed that the rain-fall of all months was higher during 2010 compared to the year 2009. It is also worth mentioning that, there were no rains in September and October of the year 2009.

Table 2. Monthly and seasonal rainfall values for Doka site during 2009 and 2010 growing seasons.

	Rain fall in mm	
Month	2009	2010
June	56	77
July	223	261
August	162	241
September	Nil	181
October	Nil	17
Total	441	777

In general the performance of the crop was better in season 2010 as compared to 2009 where pod yield (t/ha) was almost doubled in 2010. More-specifically, the pod yield increased from 1.6 t/ha in 2009 to 2.8 t/ha in 2010 (Table 3). This might be attributed to the longer rainy season and higher amount of rain fall in 2010 compared to 2009 (Collinson, 1995).

Statistical analysis showed that sowing date in both seasons, has highly significant effects on most of the measured parameters, viz., plant height, canopy width, 100 seed weight and pod yield (t/ha). Shelling percent was not affected during the second season (Table 3)

The early sowing the crop has significantly taller plants, wider canopy width, higher pod yield and heavier seeds in both seasons and their combined means (Table 3). For instance, a clear pattern of higher yields with early sowing is observed in both seasons which come in line with the farmers practice. It seems that the late sown crops were exposed to lower rainfall amounts during pod filling, which was also accompanied with reduction in 100 seeds weight (Karikari *et al*, 1995). The shelling % appeared to be inversely related to the 100 seed weight, This suggests are compensatory yield components (Ngut 1995).

Table 3. Effect of sowing date on plant height, canopy width, shelling percent, 100 seed weight and pod t/ha of Bambara groundnut at Doka site during 2009, 2010.

Sowing date	Plant height (cm)	Canopy width (cm)	Shelling %	100 seed weight (g)	Pods yield (t/ha
		Season 2009			
27/ 6/2009	23.0	34.3	35.5	71.4	3.4
9/7/ 2009	23.0	33.6	45.0	58.1	1.3
19/7/ 2009	22.1	32.1	51.0	59.1	1.1
27/7/2009	22.1	31.0	61.3	40.6	0.8
Mean	22.6	32.8	46.8	57.3	1.6
Sig. level	*	*	***	***	***
SE ±	0.3	0.8	2.9	1.6	0.1
C.V. %	5	9	24	11	20
		Season 2010			
27/6/2010	36.3	27.8	35.5	73.5	5.1
9/7/2010	34.1	25.9	45.0	64.3	3.4
19/7/2010	31.8	23.1	51.0	57.8	1.5
27/7/2010	28.6	21.0	61.3	48.8	1.1
Grand mean	32.7	24.4	46.8	61.1	2.8
Sig. level	***	***	***	***	***
SE ±	0.9	0.5	2.9	3.1	2.6
C.V. %	10	8	24	20	37

Table 3. Cont.

Sowing date	Plant height (cm)	Canopy width (cm)	Shelling %	100 seed weight (g)	Pods yield (*t*/ha)
Combined (2009 and 2010)					
27/6/2009-2010	29.7	31.1	35.8	73.3	4.3
9//7/2009-2010	28.6	29.8	37.5	61.0	2.3
19/7/2009-2010	26.9	27.6	45.0	58.5	1.3
277/2009-2010	25.4	26.0	51.6	44.8	0.9
Grand mean	27.6	28.6	42.5	59.4	2.2
Sig. level	***	***	***	***	***
SE ±	0.4	0.5	1.9	1.8	0.1
C.V. %	9	9	25	17	34

*, **, *** = Significant at P 0.05, 0.01, 0.001 significant, respectively

Plant Spacing:

The number of plants/unit area has not affected the performance of the crop during the second season, 2010 (Table 4). However, significant variations were obtained for some parameters in the first season (2009), which might be explained by the stress imposed by the early stoppage of rainfall (Table 2). Nevertheless, the results suggested higher yields with wider spacing which comes in agreement with the findings of (Rassel 1960).

Sowing date X plant spacing interaction:

A slight interaction was observed between the two factors in the first season (2009) for pod yield (Table 5). For pods yield it is very clear that the interaction between sowing date and spacing has increased pod yield by 35%, 44%, 53%; 71.4 and 85% respectively. Narrow spacing resulted in increased yield (74.4 %) compared to wider spacing.

Table 4. Effect of population density on plant height, canopy width, shelling percent, 100 seed weight and pod yield/ha of Bambara groundnut at Doka site during 2009, 2010 and their combined means.

Spacing (cm x cm)	Plant heigh (cm)	Canopy width (cm)	Shelling%	100 seed weight (g)	Pod yield (t/ha)
		Season 2009			
40 x 30	22.8	34.3	44.7	64.8	2.0
40 x 20	22.4	33.6	45.9	64.1	1.8
30 x 30	22.8	32.1	47.2	63.6	1.7
30 x 20	22.5	31.0	48.7	58.2	1.4
20 x '20	22.4	32.8	48.7	48.2	1.3
Grand mean	22.6	32.8	46.8	57.3	1.6
Significance	NS	**	NS	***	***
SE ±	0.3	0.9	3.2	1.8	0.1
C.V. %	5	9	24	11	20
		Season 2010			
40 x 30	32.8	25.6	35.4	63.6	3.0
40 x 20	32.2	25.8	35.8	61.9	3.0
30 x 30	32.1	24.0	37.0	61.6	3.0
30 x 20	34.6	23.9	39.9	59.9	2.5
20 x 20	31.7	23.7	41.5	58.8	2.3
Grand mean	32.7	24.4	37.9	61.1	2.8
Significance	NS	NS	NS	NS	NS
SE ±	0.9	0.6	2.9	3.5	0.3
C.V. %	10	8	27	20	37

Table 4. Cont.

Spacing (cm x cm)	Plant heigh (cm)	Canopy width (cm)	Shelling%	100 seed weight (g)	Pod yield (t/ha)
		Combined			
40 x 30	28.6	29.2	41.1	63.3	2.4
40 x 20	27.8	29.6	41.5	63.0	2.3
30 x 30	27.5	28.9	42.2	59.0	2.2
30 x 20	27.5	28.4	42.8	58.1	2.2
20 x 20	27.0	26.9	44.7	53.5	2.1
Grand m Ean	27.6	28.6	42.5	59.4	2.2
Sig. Level	NS	*	NS	**	NS
SE ±	0.5	0.5	2.1	2.0	0.2
C.V. %	9	9	25	17	34

*, **, *** and NS = Significant at 0.05, 0.01, 0.001 and not significant, respectively.

Table 5. Interaction between sowing date and spacing for pod yield (t/ha) during 2009 season.

density	S1	S2	S3	S4
P1	2.7	1.7	1.6	1.4
P2	2.6	1.6	1.5	1.3
P3	2.6	1.6	1.5	1.3
P4	2.4	1.6	1.3	1.1
P5	2.4	1.3	1.2	1.0

S= spacing; P = population density

CONCLUSION

1. From the result of this study, Bambara groundnut has proved to be a high yielding crop under rain-fed conditions of South Gedarif area and thus can be considered as one of the promising crop choices.
2. Agronomic studies indicated that early sowing of the crop resulted in higher yields compared to late sowing.
3. Wide spacing (i.e. lower population density) gave higher pod yields.

REFERENCES

Akonaay, H.B.and Mazige, V. (1982). Grain legumes and oil seeds. Uririguru: 50 years of Research. Tanzania Agricultural Organization, Uririguru Research Institute, Mevanza, Tanzania.

Karikari, S.K.; D.J. Wigglesworth; B.C.Kwerepe, T.V. Balole; B. Sebolai and D.C. Munthali (1995). In: *Proceedings of the Workshop on Conservation an d Improvement of Bambara Groundnut (Vigna subterranean* (L.) Versc), 14-16th of November1995. Pp: (11-29)

Ngut F.C. (1995) In: *Proceedings of the Workshop on Conservation an d Improvement of Bambara Groundnut* (*Vigna subterranean* (L.) Versc), 14-16th of November1995. Pp:21-29

Collinson.S, (1995) In: *Proceedings of the Workshop on Conservation an d Improvement of Bambara Groundnut* (*Vigna subterranean* (L.) Versc), 14-16th of November1995. Harare Zimbabwe. Pp:81-88.

Rassel, A. (1960). Levoandzeia subterranea Thou etsa culture au kwango. Bull. Ggric. Du cong Belge et du Randa Urundi 51:1-26

Smyth, k.J.F. (1968) .Bambara Groundnut or , Njugu Mawe, (*Voandzeia subterranean*). Ukiriguru Res .Notes12 .Mininistry of Agriculture,Ukirigiru, Mwanza, Tanzania.

الانتاجية المحتملة وبعض الممارسات الحقلية للفول ابو نقوى تحت ظروف الرى المطرى في منطقة جنوب القضارف

ابراهيم الصديق ابراهيم, علي التوم حسن, جمال الخير

المستخلص: أجريت الدراسة لمعرفة تأثير تاريخ الزراعة والكثافة النباتية على انتاجية محصول الفول ابونقوى. استعملت فى التجارب أربعة مواعيد زراعة كانت كالاتى: 27 يونيو، 9 ، 19 و27 يوليو. خمسة كثافات نباتية مختلفة تمثل التباعد الاتى بين النباتات و بين الصفوف: 40 سم* 30سم ، 40*20 ، 30*30 ، 30*20 و20*20 ، خلال الموسمين. وقد جمعت البيانات في كلا الموسمين : طول النبات ، عرض قطاع الاوراق، وزن ال100 حبة، نسبة التقشير ، وانتاجية بوحدة المساحة طن⁄هكتار. وقد اظهرت النتائج ان هنالك فروق معنوية فى معظم القاياسات التى اجريت بالنسبة لتاريخ الزراعة. وقد اوضحت الدراسة ان التبكير فى الزراعة ادى الى فروق معنوية عالية فى انتاجية القرون بلغت (4.3 طن⁄هكتار) عند مقارنتها بالزراعة المتاخرة والتى نتج عنها تدنى فى الانتاجية حيث بلغت 2.3 ، 1.3 و0.94 طن⁄هكتاروذلك لتواريخ الزراعة 9 ، 19 و27 يوليو على التوالى. اثرت الكثافة النباتية المختلفه تاثيرا معنويا فى انتاجية القرون فى الموسم الاول فيما لم يلاحظ تاثير معنوي فى الموسم التالى. ومع ذلك فقد لوحظ ان الزراعة علي مسافات متباعدة ادت الى تحسن في الانتاجية. لذلك فان الزراعة المبكرة والتى تكون فى اواخر يونيو الى اول يوليو هى التى تقترحها الدراسة لتكون افضل تاريخ لزراعة محصول الفول ابونقوى ، وايضا مع تباعد نباتات 40 الى30 سم كتباعد بين الصفوف و30 الى 20 سم كتباعد بين النباتات فى منطقة جنوب القضارف تحت ظروف الرى المطرى.