## SHORT NOTE

# Effect of fallow and non-fallow with sugarbeet on maize (*Zea mays* L.) performance in Guneid Sugar Scheme

**Salaheldin A. Mukhtar[1] and Abu Elhassan S. Ibrahim[2]**

[1] Sugarcane Research Center-Guneid, Sudan.
[2] Faculty of Agricultural Sciences, University of Gezira, Wad Medani, Sudan.
Corresponding Author: salahamukhtar@hotmail.com

Maize (*Zea mays* L.) is a cereal crop grown widely throughout the world in a range of agroecological environments. More maize is produced annually than any other grain. About 50 species of maize exist and consist of different colors, textures, grain shapes and sizes. White, yellow and red seeds of maize are the most common types. The white and yellow varieties are preferred by most people depending on the region. Elzubeir and Mohamed (2011) stated that in Sudan, maize is normally grown as a rain-fed crop in Kordofan and Darfur, or in small irrigated areas in the Northern State. They reported that maize is largely used for animal feed and commercial starch production.

Cultivation of crops in large agricultural schemes follows specific rotations, with the aims of restoring soil fertility and controlling pests and diseases. It is expected that the previous crop or fallow in the rotation will have conspicuous effect on the subsequent crop. Fallow is commonly referred to as a resting period for agricultural land between two cropping cycles during which soil fertility is restored with many other benefits (Styger and Fernandes, 2006). ***Cusimano** et al.*, (2014) reported that short-term fallowing had increased the quantity of carbon, soil organic matter and nitrogen. Crops differ in their recovery of nutrient fertilizers. It is reported that sugar beet recovery from N fertilizer was as much as 77% (Vallis and Keating, 1996).

In this connection, the objective of this study was to compare the effect of the land left fallow to that grown with sugarbeet on the performance of subsequent maize cultivation in Guneid Sugar Scheme, Sudan.

This study was conducted in the Sugar Research Center-Guneid farm in Guneid Sugar Scheme, Sudan. The soils were Vertisols with more than 40% clay. Soil properties were described by Mukhtar (2015). The experiment consisted of two treatments:

1. The land was grown with sugarbeet which stayed in the soil for 6 months from November 2014 to April 2015 and then left fallow up to 1/11/2015. Sugarbeet was fertilized with 50 kg of triple superphosphate ($P_2O_5$ 48%) and 100 kg of urea (46%N) per feddan.
2. Land was left fallow from November 2014 to November 2015.

Treatments were arranged in a completely randomized design with 10 replicates. Land was prepared with deep ploughing, harrowing and leveling. Maize was sown on ridges 10 meters long, 80 cm between rows and 15 cm between plants. Maize variety *Yellow Baladi* was sown in the first of November, 2015. Fertilizers were not added to any plot. Irrigation and weeding were done as required. Harvest was done on 20 March, 2016 at physiological maturity. One meter was harvested randomly from a row of each plot and the following measurements were taken: Fresh forage yield

(t/feddan), plant height (cm), cob height (cm), number of cobs/feddan, 100-seed weight (g), and grain yield (t/feddan). The data were subjected to the analysis of variance procedure.

Morphologically, the maize plants grown in the fallow land were robust, big, vigorous, dark green and tall compared to those sown in the land of the sugarbeet (non-fallow lands). The data in Table 1 show that the increase in the plant height for the fallow sown maize was 68% while the increase in the cob height was almost 100%. The character of number of cobs per feddan was not affected by the fallowing, an indication that such trait is highly genetically controlled and not affected by fertilization.

The 100-seed weight, a highly related character to grain yield, increased by 84% in the fallow land in comparison to that in the sugarbeet land (Table 1). High 100-seed weight usually requires high soil fertility furnished by fallowing.

Fresh weight per feddan, i.e. fresh forage yield, is a very important character that can convince the farmer to go for fallowing. In the Sudan, usually we have inadequacy of green forage during winter (November–March), mainly because growing forage sorghum will give low yields during this period due of sorghum photoperiodicity. Such a problem can be solved by growing maize, though the stem borer is a real problem for maize grain yield. Fallowing increased fresh forage yield by 154%, equivalent to about 10 tons per feddan. The increase in fresh forage yield is expected to be larger if the crop was harvested at flowering and not at physiological maturity as in this study. Harvesting at flowering stage will improve both the quality and quantity of the harvested crop.

Data in Table 1 also showed that increase in grain yield due to fallowing was very large (227%) equivalent to 0.5 ton per feddan or 5 sacks of grains; each sack weighs 100 kg, to convince our farmers. In central Sudan, growing maize for grains in winter is faced by the stem borer problem. In this study, it is suggested to grow maize under fallowing in Guneid Sugar Scheme mainly for green forage harvested at flowering stage to escape the stem borer attack and to sustain forage quality. It is very difficult to convince farmers with such recommendation because they concentrate mainly on quantity and not quality.

Table 1. Effect of fallow and land grown previously with sugarbeet (non-fallow) on fresh forage yield, grain yield, and yield components of maize, Guneid Sugar Scheme, 2015/2016.

| Character | Fallow land | Sugarbeet land | Increase (%) | S.E. (±) | C.V. (%) |
|---|---|---|---|---|---|
| Plant height (cm) | 186.3 | 111.4 | 68 | 3.6 | 7.6 |
| Cob height/plant (cm) | 126 | 66 | 91 | 4.1 | 13.6 |
| Number of cobs/feddan | 33075 | 25725 | 29 | 0.51 | 20.2 |
| 100-seed weight (g) | 13.6 | 7.4 | 84 | 0.72 | 21.7 |
| Fresh forage yield (t/fed) | 15.5 | 6.1 | 154 | 1.5 | 29.5 |
| Grain yield (t/fed) | 0.72 | 0.22 | 227 | 0.16 | 23.0 |

The current study depicted very clearly that fallowing improved soil nutrient content as well as its structure. Such improvement was shown by the increase in the vegetative growth, green forage and grain yields. Styger and Fernandes (2006) reported that the fallow (resting period) would restore the soil fertility, while ***Cusimano*** *et al*. (2014) stated that the succession of crops in the crop rotation is desired especially if tap root crops like sugarbeet are followed by adventitious rooted crops like maize. Vallis and Keating (1996) suggested that when sowing heavy feeder crops like sugarbeet, the land should be adequately fertilized for the next crop.

The recommendation of this study, i.e. sugarbeet land in Guneid Sugar Scheme, is suggested to be left fallow for a period of almost 8 months and then grown with maize in winter, is faced with two problems. (1) Is it economical to leave the land fallow for this long period? And (2) Is it possible to convince the farmer to leave his land without cultivation for this long period. Fallow lands in this scheme are used for grazing and consequently damaging the soil structure (hard pans) due to animal footing. Such questions need further studies to be answered.

However, in other sugar schemes in the Sudan, where cane after cane was the adopted policy and no farmer exists, this study depicts the importance of the fallow period. It is clear that the fallow land surpassed the sugarbeet land (non-fallow) although the crop was fertilized with nitrogen and phosphorus. So, when growing heavy feeder crops that consume most of the added fertilizers, especially nitrogen, such as sugarbeet, N fertilizer should be added.

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# تأثير البور وغير البور بزراعة بنجر السكر على نمو و إنتاجية الذرة الشامية بمشروع سكر الجنيد (*Zea mays* L.)

صلاح الدين عبدالقادر مختار[1] و أبو الحسن صالح إبراهيم[2]

[1] مركز بحوث قصب السكر- الجنيد ، السودان.

[2] كلية العلوم الزراعية، جامعة الجزيرة واد مدنى، السودان.

## الخلاصة

يعتبر ترك الأرض بوراً (بدون زراعة) لفترة محددة من أهم مكونات الدورة الزراعية لتحسين خواص التربة و قد يستعاض عنه بزراعة محصول بقولي حولي لتثبيت النيتروجين. يقترح زراعة بنجر السكر بمشروع سكر الجنيد وبعض مشاريع السكر الأخرى بالسودان للاستفادة من الأرض التي لا تجود فيها زراعة قصب السكر و لخلق نوع من الدورة الزراعية. بنجر السكر محصول حولي يشغل الأرض لفترة محددة و باقي العام يمكن زراعة محصول علفي حولي مثل الذرة الشامية. هدفت هذه الدراسة لمعرفة تأثير البور على إنتاجية علف غلة الذرة الشامية. نفذت التجربة في الفترة ما بين نوفمبر 2014 و مارس 2016 بمعاملتين (1) تركت قطع أرض بوراً من نوفمبر 2014 حتى نوفمبر 2015 و (2) زرعت قطع أرض أخرى بمحصول بنجر السكر من نوفمبر 2014 و حتى أبريل 2015 ثم تركت بورا حتى نوفمبر 2015. زرعت كل القطع بمحصول الذرة الشامية في نوفمبر 2015 و لم تضاف أي أسمدة للتجربة وحصدت في مارس 2016. أستخدم التصميم العشوائي الكامل لجمع بيانات عن نمو وإنتاجية غلة وعلف الذرة الشامية. أظهرت نتائج الدراسة تفوق كامل للمحصول الذى زرع بالأرض البور على الأرض التي زرعت ببنجر السكر في كل الصفات المقاسة. كانت نسبة الزيادة كالآتي: 68 و 91 و 29 و 84 و 154 و 227% لصفات طول النبات وطول الكوز وعدد الكيزان للفدان و وزن المائة حبة و إنتاجية العلف الأخضر للفدان و إنتاجية الحبوب للفدان على التوالي. كانت إنتاجية الأرض من البور و الغير بور من العلف الأخضر 15.5 و 6.1 طن للفدان على التوالي، أما عن الغلة فكانت 0.72 و 0.22 طن للفدان. التوصية بترك الأرض بورا تقابل بعدة مشاكل منها الناحية الاقتصادية وإقناع المزارع بترك أرضه بوراً لمدة عام كامل. كما أن الأرض البور تعتبر مرعى للحيوانات مما يسبب مشكل كتصلب التربة و تكوين طبقات غير نافذة. عليه يجب الإجابة على هذه الملاحظات قبل التوصية. إلا أنه في مشاريع السكر الأخرى في السودان و التي تعتمد سياسة زراعة قصب سكر بعد قصب سكر بدون أي بور وليس بها مزارعين، يجب اعتماد فترة بور مناسبة لاستعادة خصوبة التربة كما أنه في حالة زراعة محاصيل شرهة التغذية كقصب السكر و بنجر السكر يجب إتباع معاملة تسميديه واعية.