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Effect of Acacai seyal Del tree age and distance on sorghum (sorghum bicolor) germination and mortality

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Abstract

A.seyal trees are widely spread species in Sudan, that could be recommended as agro forestry species but before that the existence of inhibitors must be examine . so this study was conducted in order to investigate the effect of tree age and the distance from the tree crown on the germination and mortality of sorghum. four categories diameter at breast height as indictor of the trees age selected (32-51cm, 52 -71cm, 72-81 cm and 82 –above cm) and Five trees in each category and two sorghum varieties (Tabat and HSD) were grown underneath these trees in different distance after the crown (1, 2 and 3 meter) The germination percentage, seedling mortality were recorded. The results showed that the oldest trees have significantly decreased the germination percentage even when the sorghum (Tabat variety) was grown 3 meter far from the crown (table 1). But when this experiment was repeated with anther variety (HSD) the results were little bit varied . the seedling grown underneath the oldest trees(91- ≤ cm) had the lowest mortality percentage for both varieties and three distance from the tree crown (1,2 and 3 m). This results suggest that the different varieties have different response to inhibitors released by A. seyal trees.

Key words:Tree age, germination, mortality, distance, varieties.

1. Introduction:

Allelopathy is a biological phenomenon by which an organism produces one or more biochemicals that influence the germination, growth, survival, and reproduction of other organisms. These biochemicals are known as allelochemicals and can have beneficial (positive allelopathy) or detrimental (negative allelopathy) effects on the target organisms and the community. Allelochemicals are a subset of secondary metabolites (Stamp 2003).

Agroforestry has drawn considerable attention because of its potentialities to maintain or increase the biological productivity in areas characterized by high energy input and large-scale impractical agriculture (Kidd & Pimentel, 1992). But the researches showed that Acacia trees are known as a versatile source of components with bioactive properties (Reigosa et al., 1984; Rafiqul Hoque et al. , 2003), suggesting a large inhibitory potential in Acacia genus which dominates the dry south Saharan regions of Africa (Barnes et al., 1996).The accumulation of the inhibitors in the different parts of the plant were different as mentioned by Kamel and Hammad(2015) that the leaf extract of Acacia saligna exhibits higher inhibitory effect than stem extract. The growth parameters as shoot and root length, fresh and dry weight and vigor index showed continued decrease with the increasing of allelopathic extract concentration. In Acacia tortiles the inhibitory effect was more pronounced in fruit and leaf extracts compared with root, shoot and soil extracts .(Noumi and Chaieb, 2011). Also the accumulation of the inhibitors differ underneath the plants in both sides horizontally and vertically , The soil from the A0 horizon collected near the eucalyptus species trunk was slightly inhibitory, whereas, the A0 horizon soils collected at 2.5 and 5 m away from the trunk were slightly stimulatory. This pattern supports the hypothesis of higher allelochemical concentration in the A0 horizon close to the trunk than in other soil positions (Espinosa -Garcia,2008).The response of different crops to the inhibitory effect is different according the plant species. Wheat seeds were more tolerant to the allelopathic action of A. saligna extracts than canola.(Kamel, Hammad,2015) and . Inhibitory effect was minimum on maize and maximum on black bean when grown under.(Espinosa -Garcia,2008) Acacia seyal is Nitrogen-fixing species that is excellent for silvo-pastoral systems. The bark provides valuable forage for cattle and game and leaves and pods are used for fodder Also used for gum production (gum talha) though not as valuable as gum Arabic's is an important source of fuel wood and charcoal. But the local farmers do not planted crops underneath the A. seyal trees , they thought that it poisoning the crops. So this study was aimed to test the inhibitory effect of A. seyal trees on two sorghum (Sorghum bicolor) varieties and is the effect of the trees age of the trees on accumulating inhibitors beside the distance from the tree crown.

2. Materials and Methods:

Trees of Acacai seyal trees in natural stands were selected and grouped in four categories (32-51cm, 52 - 71cm, 72-81 cm and 82 –above cm) according to the diameter at breast height as indictor of the trees age. Five trees in each category were selected and two sorghum varieties (Tabat and HSD) were grown underneath these trees in different distance after the crown (1, 2 and 3 meter) The germination percentage, seedling mortality were recorded.

3. Results and discussion:

The accumulation of plants residues are affected by the age of the tree which accumulate year after year and the distance from beneath the tree crown, so this two factors were investigated. The results showed that the oldest trees have significantly decreased the germination percentage even when the sorghum (Tabat variety)

was grown 3 meter far from the crown (table 1). But when this experiment was repeated with anther variety (HSD) the results were little bit varied (Table 1) this variation may due to harsh conditions of the experiment field or to variety sensitivity. Many studies showed that the different plant species affected differently by the inhibitors but there were no studies about the variety sensitivity, so it will be of a great value to conduct such studies. Another parameter was tested to evaluate the allopathic effect of tree age and the distance which is the percentage of the seedlings mortality . The results showed that the seedling grown underneath the oldest trees(91- ≤ cm) had the lowest mortality percentage for both varieties and three distance from the tree crown (1,2 and 3 m). Under the young trees (32-51 cm) after I meter it had the highest motility percentage in the two varieties and after 2 meter from the crown it had low mortality percentage and after 3 meter in variety Tabat low mortality percentage while HSD variety had high mortality percentage(fig 1, 2 and 3). These results suggested that the substances that released by the trees inhibit the germination rather than lethal effects and this reaction is influenced by the variety type. So instead of rejecting A. seyal as agro forestry species due to its inhibition effects further studies must be conducted to determine which species could be grown vigorously underneath A. seyal trees and go further than that and examine the varieties sensitivity towards this inhibiting substances. This results were agreed with Rao and Reddy (1984) who revealed that leaf extracts of Eucalyptus tereticornis inhibit germination of crop seeds to a certain extent. The germination per cent increased in horse gram, green gram and cowpeas, indicating that leaf extracts may have some stimulatory effect on some species of plants and Thakur and Bhardwaj (1992) who studied the effect different tree species leachates from leaf extracts on wheat and maize seeds and found that Wheat germination was not significantly affected by exposure to the leachates but maize germination rate was decreased to 89% when compared to control

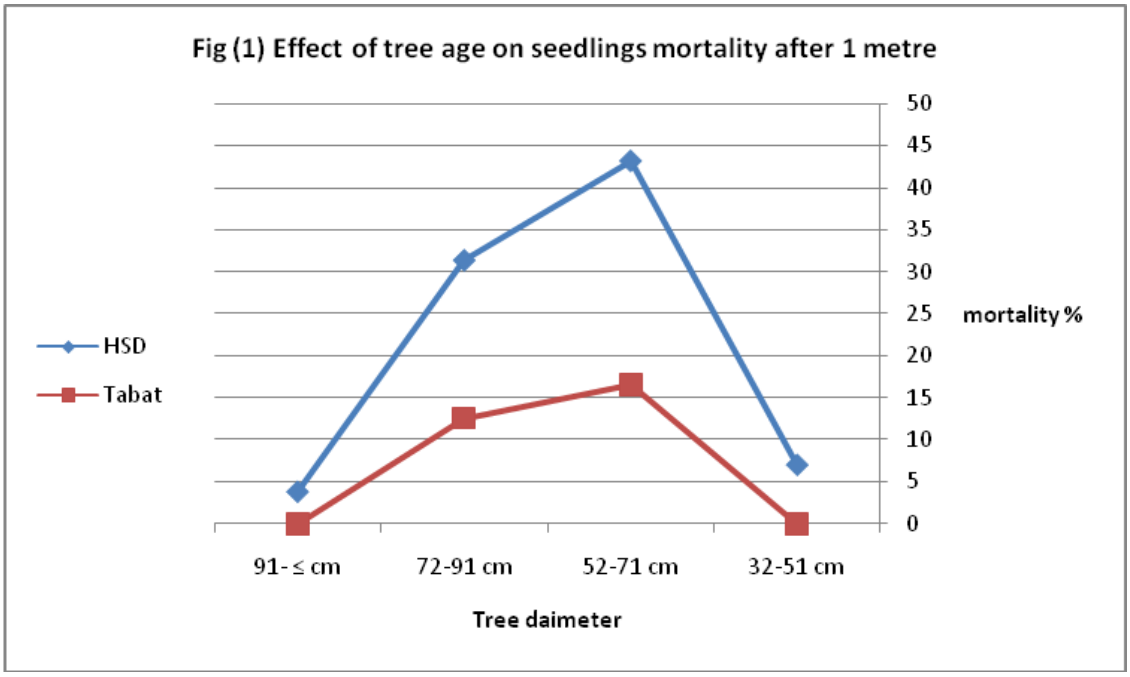

Table 1) Effect of tree age on germination % of sorghum grown after 1, 2 and 3 meter from the tree crown

Tree diameter	Mean of germination % after 1metre		Mean of germination % after 2metre		Mean of germination % after 3metre	
	Tabat variety	H S D variety	Tabat variety	H S D variety	Tabat variety	H S D variety
32-51 cm	50.1 a	32.9 a	59.4 a	41.5 a	47.8 a	30.8 b
52-71 cm	43.1 a	32.7 a	38.4 b	41.4 a	43.7 a	38.3 b
72-91 cm	34.4 a	16.7 ab	43.6 b	35.2 a	46.2 a	50.1 a
91-≤ cm	3.8 b	10.6 b	30.1 b	22.9 a	10.6 b	0 c
p≤	0.0026	0.068	0.014	0.59	0.011	0.0001
SE ±	4.3	6	4.7	24	6.6	2.7
Cv	60	58	80	94	50	66

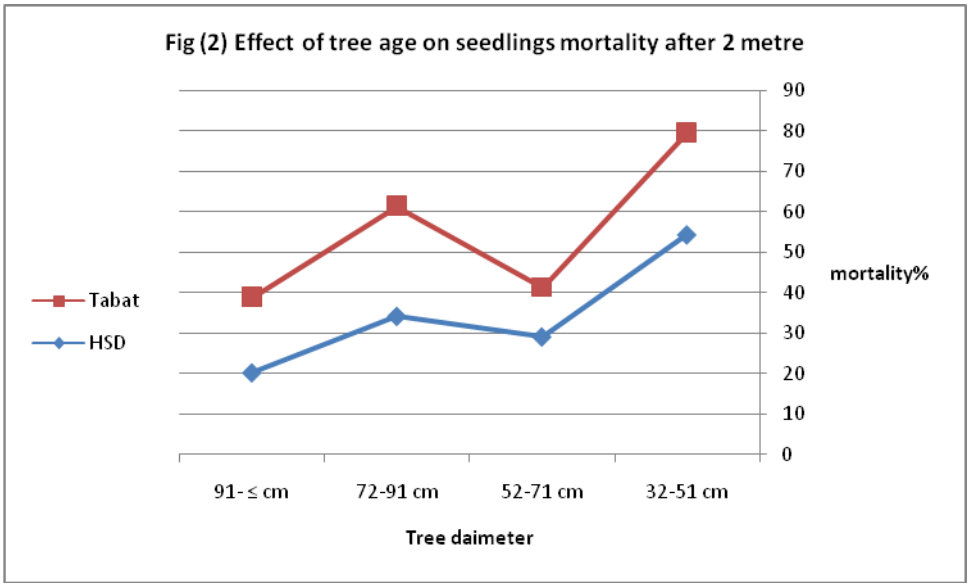
Fig (2) Effect of tree age on seedlings mortality after 2 metre
90
80
70
60
50
40
30
20
10
0
mortality%
Tabat
HSD
91-≤ cm
72-91 cm
52-71 cm
32-51 cm
Tree daimeter

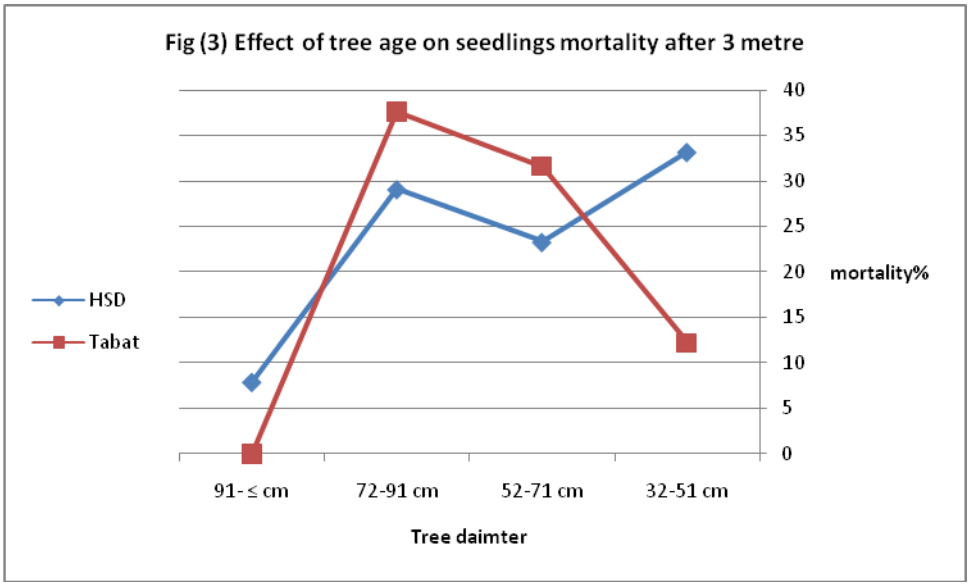
Fig (3) Effect of tree age on seedlings mortality after 3 metre
40
35
30
25
20
15
10
5
0
mortality%
HSD
Tabat
91-≤ cm
72-91 cm
52-71 cm
32-51 cm
Tree daimter

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