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Effect of Density on Height and Dry Weight of Acacia Senegal and Acacia Mellifera

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ABSTRACT

The aim of this study is to investigate the effect of plant density. To know the effect, the measurements of the height and dry weight of the seedlings of Acacia melliferaand Acacia Senegal was done. The viability of seeds used in the experiment is very high. Acacia melliferaviability is 96% while the seeds of Acacia Senegal are 95%.The result of the study showed that, the plant density has an obvious effect on height and dry weight of seedlings.Also the study conducted that, the suitable methods is to used the plant density in order to minimize the number of seedlings according to purpose of planting trees.

Keywords:*Cutting,purity, moisture content, germination test.*

1. INTRODUCTION

Densitymeans thenumbers of plantsortreesper unit areaor the amount and volume ofshootBiomassper unit area(Abubakar, 2000).Theplant densityaffect the growthandform oftrees and onsoil properties. In case ofvery dense forest, competition betweentreesin general wouldbe severeand may endin favor ofstrong trees, where itisdominanton forest floor and result in the death oftrees.Alsofind that thecompetitionforaccess tolightleads toincreased growthand death ofthe uppersub-branches lower(natural pruning), and lead to adecline ingrowthaccidental. Grown trees indensewoodlotscharacterized by tight andsmallcrown, few branches, cylindricalshapeand increasein length, compared to the individualtreesthat growinortimberlands notdense,wherewe find that thecrownbroad andlarge branchside also big. Hightreedensitylead to adelay inthe production ofseedsfor ten years,and therefore thetreesdeveloping outside thedense woodlots, produce seeds beforedeveloping treesintodensewoodlotsthis is dueto the competition forthe nutrientsthatunder control of developing trees inwoodlotsto formtheirvegetativeparts. Theproblem of the study there is affecting ofplant densityon growth andthusaffectthe properties oftreesonthe variousstages ofgrowth, also affectthe productivity ofseeds, delayeddurationand there was novigorous studiesto find outother influencessuch asthe impact ofplant densityon the rise and dry weight. The objectives are todetermine the impact ofplant densityon growthin bothheight anddry weight of Acacia Senegaland Acacia meliferaand tofindthe bestways tousethe appropriatedensityper unit area.

2. DESCRIPTION

2.1 Acacia Senegal

Small tree or shrubupto eightmeters inheight, has a crownshapebetween theflatcircular(Sahani, 1968).And is famous forthe production ofgum Arabicand caneasilydistinguishthisshrubbyblackthorns that which appear ingroups of threeforks(notinpairslike the othertreesAcacia), the two lateral thorns are bent tothe top,whilethe middlefork, bent downand length(0.5)cm. and the blossoms consistsofSpikescentralyellowishwhitein color, fruitlengthbetween7-10cmand color oflight brown in form of leaves(Voget, 1987).

3. SOURCE OF SEEDS

The seeds of Acaciamelifera whichwere plantedin the nursery, has beenobtained from the National Centre forseedsof trees, Soba, Khartoum 2007.The seeds oftwo Acacias were selectedfrom Bootarea in Aldmazzin State (BN - 07-201), seeds zonenumber1.2 to 2.1.The annualrainfallbetween800 -950 mm. Betweenlongitude 9° 11North and latitude 9° 31East.The Region rises650 metersabove sea level.The soil is clay andcracked .The vegetationcoverare,Acaciastreesandtallgrasses. The populationactivities areagriculture andgrazing . The seeds source of Acacia Senegal isKhorDonia atAldmazzinState (BN - 07-121), it's an area of seeds zone number 2.1 to 5.2. The annual rainfall between 800 -950 mm. Located on the longitude 8°.12. North andlatitude 30°.1.East.Risesup to 600 meters above sea level. The cracked clay soil is dominant.

4. METHODOLOGY

1. The methodsof International Seeds Testing Association (ISTA RULES, 1993) were used for the following tests:-

- Number ofseedsperkilogram,
- Cutting,
- Purity,
-Moisture content,
-Andgermination test.

2. Observations.

4.1 Number of Seeds Per Kilogram

Eightrandom sampleswere taken, eachsample included 100 seeds, weighted each sampleseparately.Theeightweights subtracted to obtainthetotal weight of thesamples and dividedby(8)samplesto gettheaverage weight ofthe100 seeds. Thennumber of seedsper kilogram can obtain bythe following equation: -

No. of seeds perkilogram= 1000000/ (weight of100 seeds)

4.2 Cutting Test

Random sample of100seedsfrom two typesof Acacia melifera and Acacia Senegalseeds,cut offaccidentallyby seedsscissorsto see theviability of seedsby lookingwith the naked eyestheinternal components.Alsoused ahandlensto seea dynamicviability by observation ofthe seedcolor.If thecomponents ofthe seed arewhiteoryellowlightthisis evidence of theviability ofthe seed,and my bedeadiffragmented and its black colororbrownandcan be knownthatthey are emptyofcomponents.

4.3 Purity Test

4.3.1 Acacia Mellefera

Tow random sampleswere taken, first sampleweight(35.004 g) and the second weight (35.104 g), then separated the two samples into threegroups they are ;pureseeds , impuritieswhich consist(cover of seedsor the remnants ofthe flowers,branches orsoil particles)andother seeds weighed to getthe percentage.

4.3.2 Acacia Senegal

Two random samplesof Acacia Senegal were taken,the first sampleweight 35.046gmand the second 35.053 gm, separatedby handfor threegroups;pure seeds,impuritiesand the other seeds. Pure seeds Weighedandattributed to theweight ofthe sampleto obtain thepercentage ofthem.

4.4 Moisture Content

Two random seedssampleswere taken,each sampleweight(10)gmto test themoisture contentasfollows:

a. Weighted the empty pot, it has 15mmdiameter
b. Put the pot full withseedsin the ovenwith at temperature(102 ± 3)℃ for17 hoursand thendriedtoaboutan hour.
c. Record the dry weight and calculated moisture ratio by the formula:

Moisture % = Moisture(dryweightof the vessel- dry weight ÷weight of an emptyvessel and sample–weight of dry empty vessel) × 100

4.5 Germination Test:

Germinationtest is done to know theability ofthe seedsto produceseedlingsorgestureby whichunkempttrees inforests andnurseries. Hundred100 seeds were taken randomly for4 replicatesin eachreplicate25seeds, thenplanted in plastic tubeswithout treatmentand thenkeptatgerminationroom ,exacttemperatureand lighting(12 hourslightbulbsneonat 30 °+1m) andis irrigatedfor one month.

5. CULTIVATION PREPARATION

120 seedsofAcacia Senegal and Acacia meliferain high-purity were putinacool storefor two monthsintemperature(12-14 C)and4.5%relativehumidity.

Conductedtreatment to the two Acacias seeds usedthe needleElectric burnerwhich is(a metal wireits diameter 0.7mm forthe large seeds and 0.1for small size seeds and has awooden handleinsulatorpass throughthe wireconnectorelectricallywhich operatingon theheatingwire andblowing , using the glowing partyin conducting hole or smallburnin theseed coat, which leads toeasyabsorptionof seeds for water,theneasy togerminateand this methodgavegood resultsin the process ofgermination (Pate,1and 2).

5.1 Type of Soil

UsedCelticsoil (Griara) as the bestsoil typessuitablefor the growth ofAcaciameliferaandAcacia Senegal, asthey are morecommonly soils usedinnurserybecause they are richwith important chemical elements.

5.2 TypeofCommodes Used

Plastic commodes -length 20 cm andawidth of 30cmwereused in thenursery.

5.3 Method ofirrigation

Streamlineirrigationmethod was used, according to the recommendationsadoptedin thenursery,because theseeds coat of two Acaciasarethinwalland not tolerate immersionfor long periods.Theirrigationprocess continueddailyfor a month.

5.4 Method ofcultivation

Determinationrequired intensity for the types and dividedinto three groups: -

Group A: Consists of 5seedswhichrepresentthe control.
Group B: 10seeds
Group C: 15seeds

Each groupwas dividedto 14replicates.

5.5 Follow-Up

Cultivating the seeds two samples in the nurseryandgerminationprocess happenedin the third day (plate 3and4).Adifferent readings of seedlings heightand germination ratio weretakenevery weekfor 4 weeks. Alsothree samplesfromeachreplicate were randomlytaken andmeasured themin the laboratoryfor shoot ,root lengthand number ofleaves.Then tookthree samplesrandomlyfromeachreplicateoftwoAcacias in the last weekbefore theend of the experimentconductedby the samemeasurementsasthe secondmeasurement.

5.6 Method of Analysis

Using Analysis of Variance (ANOVA).

5.7 Results

Table 1: Cutting tests

species(sp.)	dead seeds	affected seeds	alive seeds	Total
A.Senegal	2	2	96	100
A. melifera	1	3	96	100

Table1:showsthat 96seedsfor the two samplesare healthy andalive,whilethere are2 seeds of Acacia melleferaandthree of Acacia Senegalwereinfectedseeds.

Table2: Number of seeds perkilogram(kg)

No.of samples	weight of samples	
	Acacia melifera	Acacia Senegal
1	4.620	9.197
2	4.692	8.998
3	4.992	9.341
4	4.782	8.560
5	4.644	8.672
6	4.517	8.721
7	4.642	8.564
8	4.658	8.918
Total	37.547gm	70.971gm
Aver.	4.693 = 37.547 ÷8gm	70.971÷8=8.87gm
Aver. Wet. of100seeds	4.693÷10=46.93gm	8.871÷10= 88.71
No. of seeds/kg.	1000000÷46.93=21308 seeds	11272seeds

Table3: Purity test ofAcacia Senegal seeds

No. of sample	Wt. ofsample /(gm)	Cleanseed wt./(gm)	impuritiesWt/(gm)	Otherseed wt.(gm)	%pureseeds	%impurities	% otherseeds	Ave.oftwo samples
One	35.004	35.00	0.004	0.00	35×100÷35.004 =99.99	0.004×100÷35.004=0.011	0.0×100÷35.004 =0.0	99.99+99.41÷2=99.7
Two	35.104	34.896	0.208	0.00	34.896×100÷35.104=99.41	0.208×100÷35.104=0.591	0.0×100÷35.104 =0.0	

Table4: Purity test ofAcacia mellefera seeds

No. of sample	Wt. sample /(gm)	Cleanseed wt. /(gm)	Impurities Wt /(gm)	Otherseed wt.(gm)	%pureseeds	%impurities	%of otherseeds	Ave.oftwo samples
One	35.046	32.950	2.061	0.00	32.950÷35.046×100= 94.02	2.061÷35.046=5.7	0.035÷35.046×100=0.099	94.02+91.02÷2 =92.2
Two	35.053	32.722	2.231	0.00	32.722÷35.053×100=91.02	2,231÷35.053×100=6.2	0.00÷35.053 × 100 = 0.0	

Tables3 and4noted that the seeds ofAcaciamellefera and Acacia Senegal are high puritywithvery fewimpurities andotherseeds, and so its reflects that the collection of seeds are soundand clean.

Table5: Germination% of Acacia mellifera seeds

Time	5seeds%(control)	10 seeds%	15 seeds%
first week	60	87.5	70
second week	60	85	68.3
third week	60	85	68.3
Aver.% germination	60	85.2	68.9

Notefrom Table(5)that the percentage ofgerminationof fiveseedsincontrolwas60%in the threeweeks,andthatbecause ofthe inabilityof theseeds toabsorb water, leading torot.As forgermination(10)seeds, thegermination percentage were 87.5%in the first weekand 85%. in thesecond and third weeks,while 70% of the germination ofthe(15)seedwasin the first weekand gave68.3%ofgerminationinthe next two weeksduetothe death ofsomeseedlingsofanintense competitionto absorb waterand foodintheirthird week.Averagepercentagegerminationof 5seedsincontrol (10), (15)in thethreeweekswere as follows:60%,85.2%and68.9%respectively.

Table6: Germination%of Acacia Senegalseeds

Time	5seeds % (control)	10 seeds%	15 seeds %
first week	65	87	73
second week	65	85	73
third week	65	85	73
Aver.% ofgermination	61.1	85	76.3

From table(6) the percentage ofgerminationof 5 seedsincontrolwas55%in the first week, and increasedto 65% in the next two weeks, indicating the able of seedlings to absorb water.

At (10)seeds,the germination percentagewerefixedand equal85%in bothweeks andthat indicates thefactorof competition betweenseedsforspeed ofgermination, whilethere is73%germinationof(15)seedsin the first weekand 78% in the next two weeks.This is proofthat theability of seeds to absorptionof waterand food.Average percentage germination of 5 seeds in control (10) and (15) in the three weeks were 61.7%, 85% and 78.3 respectively.

4-2 Measuringthe heightof thegerminationseedlingof two Acaciaplantedin thefield

4 – 2 – 1 Measuringthe heightofgerminationseedlingof two Acaciain the first week

Table 7: Measurement ofseedlingsheightin the first weekfor thecontrol

Species	Mean(cm)	Density/seed	Probability
A.mellifera	7.125	5	
A. Senegal	3.750	5	P= 0.004

Table 8: Measurement ofseedlingsheightin the first weekfortenseeds

Species	Mean(cm)	Density/seed	Probability
A.mellifera	6.878	10	
A. Senegal	3.789	10	P= 0.002

Table 9: Measurement of seedlingsheight in the first weekfor15seeds

Species	Mean(cm)	Density/seed	Probability
A.mellifera	5.000	15	
A. Senegal	5.955	15	P= 0.02

Tables 7 ,8 and 9showed thattherewere significant differencesin themeasurements ofthe heightof two Acacias seedlingsat15seeds, while there is a weaksignificant difference ingrowing 15 seedsinthe first week.

Table10: Measurement of seedlingsheightinthe second weekfor thecontrol

Species	Mean(cm)	Density/seed	Probability
A.mellifera	10.738	5	
A. Senegal	9.167	5	P= 0.3

Table11: Measurement of seedlings heightof the 10seedsin the(second week)

Species	Mean(cm)	Density/seed	Probability
A.mellifera	9.763	10	
A. Senegal	8.738	10	P= 0.2

Table12: Measure of seedlings heightof 15seedsin the(second week)

Species	Mean(cm)	Density/seed	Probability
A.mellifera	9.421	15	
A. Senegal	8.486	15	P= 0.2

Tables10,11 and 12showedthat thereis nosignificant differenceswhen measuring theheight.

Table13: Measurementthe seedlings heightof the 5seeds(control) for the third week

Species	Mean(cm)	Density/seed	Probability
A.mellifera	6.300	5	
A. Senegal	4.750	5	P= 0.7

Table14:Measurethe heightof 10 in the third week

Species	Mean(cm)	Density/seed	Probability
A.mellifera	13.891	10	
A. Senegal	12.181	10	P= 0.2

Table15: Measurethe seedlings heightof 15 in the third week

Species	Mean(cm)	Density/seed	Probability
A.mellifera	12.800	15	
A. Senegal	12.838	15	P= 0.9

Tables13,14 and15 explained thatthere is nosignificant differenceswhenmeasuring the height oftwo Acaciasseedlings whencultivatetenand fifteenseedsin the third week.

Table 16: Measurement seedlingsheightof fourth week

Species	Mean(cm)	Density/seeds	Probability
A.mellifera	0.00	5	
A. Senegal	0.00	5	P=Zero

Table17: Measurement seedlingsheightof10 seedsin the fourth week

Species	Mean(cm)	Density/seeds	Probability
A.mellifera	12.371	10	
A. Senegal	16.083	10	P=0.4

Table18: Measurementheightof15 seedsin the fourth week

Species	Mean(cm)	Density/seeds	Probability
A.mellifera	17.414	15	
A. Senegal	18.297	15	P=0.6

Tables 16,17 and18showed thatthere is nosignificant differenceswhenmeasuring the height oftheseedlings of two Acacias whencultivatefive, tenand fifteenseedsin thefourth week. Henceit is clear thatthere is a significant differenceinheightatplantingten andfifteenseedduringfourweeks.
Measurement of height, green and dryweight for shoot and root andnumberof leaves.

Table19: First readingsofcontrol(5seeds)

Species	shoot length(cm)	root length(cm)	shoot g.wet(gm)	Root g.wet.(gm)	Shoot d.wet.(gm)	Root D.wet.(gm)	No.of Leaves
A.mellifera	11.75	2.58	0.178	0.005	0.041	0.0026	6. 25
A. Senegal	11.43	2.60	0.250	0.008	0.052	0.0024	8.25
probability	P=0.8	P=0.9	P=0.05	P=0.05	P=0.1	P=0.7	P=0.09

From table(19),there isa weaksignificant differencein thetotalweightof thegreenrootandshootand the number ofleaveswhile there is nosignificant differencesin theelongatedshootandroot.

Table20: First readings of 10seeds

Species	shoot length(cm)	root length(cm)	shoot g.wet.(gm)	root g.wet.(gm)	shoot d.wet.(gm)	Root d.wet.(gm)	no.of Leaves
A.mellifera	12.08	2.758	0.179	0.004	0.040	0.002	6. 750
A. Senegal	13.48	2.650	0.267	0.011	0.053	0.003	9.833
probability	P=0.3	P=0.7	P=0.0008	P=0.041	P=0.0037	P=0.1	P=0.0001

Table(20)there aredifferences in thenumber of leavesas there aresignificant differencesin thegreenrootandshoot and dry weightfor greenshootwhile there are no significant differencesin theelongatedshootandroot.

Table21: First readings of 15seeds

Species	shoot length(cm)	root length(cm)	shoot g.wet.(gm)	root g.wet.(gm)	shoot d.wet.(gm)	Root d.wet.(gm)	no.of Leaves
A.mellifera	12.375	3.242	0.284	0.010	0.056	0.004	8. 167
A. Senegal	16.141	4.358	0.227	0.008	0.053	0.005	8.500
probability	P=0.033	P=0.06	P=0.07	P=0.2	P=0.6	P=0.036	P=0.6

Table(21) explained thatthereare significant differencesin both length ofshootandrootand greenweightofshootanddry weightof the totalrootwhile there are no significant differencesin green weightfor the totalroot and dry weightofshootandnumber of leaves.

Table22: Secondreadings for5seeds

Species	shoot length(cm)	soot length(cm)	shoot gn.wet.(gm)	root gn.wet.(gm)	shoot dr.wet.(gm)	Root dr.wet.(gm)	no.of Leaves
A.mellifera	2.00	0.667	0.022	0.009	0.011	0.004	1.833
A. Senegal	2.64	0.542	0.064	0.018	0.006	0.007	0.917
probability	P=0.8	P=0.8	P=0.03	P=0.5	P=0.5	P=0.7	P=0.5

From table(22),there are nosignificant differencesinall readings.

Table23: Secondreadingsfor 10seeds

Species	shoot length(cm)	root length(cm)	shoot gn.wet.(gm)	root gn.wet.(gm)	shoot gn.wet.(gm)	Root gn.wet.(gm)	no.of Leaves
A.mellifera	16.625	3.142	0.343	0.015	0.069	0.003	9.00
A. Senegal	18.658	3.457	0.259	0.007	0.064	0.005	9.25
probability	P=0.38	P=0.51	P=0.04	P=0.001	P=0.59	P=0.7	P=0.8

From table(23)there is a weak significant differencein both greenweightof thetotalrootandshootanda weaksignificant differenceindry weight shoots, whilenosignificant differencesin thelongitudinalroot systemandshoot system anddry weightof shoots system andnumber of leaves.

Table24: Second readingsfor 15seeds

Species	shoot length(cm)	root length(cm)	shoot gn.wet.(gm)	root gn.wet.s(gm)	shoot dr.wet.(gm)	Root dr.wet.(gm)	no.of leaves
A.mellifera	11.725	2.467	0.149	0.0059	0.035	0.003	7.00
A. Senegal	16.208	3.867	0.349	0.049	0.070	0.004	8.00
probability	P=0.03	P=0.01	P=0.001	P=0.01	P=0.001	P=0.01	P=0.17

At table(24)there arestrong significant differencesin theallreadingsonlythe number ofleaves.

6. CONCLUSION

Theexperiments includedthe growth,measurement ofheight anddry weight ofAcacia Senegal and Acacia melifera, and one type of soil (silt) has been usedandwasirrigatedby one type of irrigation known as experiment irrigation, whereirrigatedevery dayfor a monthand theexperiment was designedon arandomfull system, in threereplicatesfor each typeas it containsfirstreplicate (fiveseeds), which represents thecontrol,the secondcontaining (tenseeds), while the third containingthe(fifteenseeds) analyzed theresults of the studystatisticallyusinganalysis of variance(ANOVA)underthe system(JMP). Thestudy provedthe existence ofhigh significant differencesbetweenAcacia SenegalandAcacia melleferainheightfor thecontrolandthis showsthe effect ofdensityon the rise. The study also confirmedthe existence ofsignificant differencesin theproperties ofthe seedlings growth,wherethese differencesincreasewiththe factor of time(age).The study confirmedthat thedensityhelps to increase the speed ofgrowth, as revealed inthe experimentthat replicates with high-density(10.15 seeds) of thetwo typesshowed an increasein the speed of growth, and this is consider one ofthe effects ofthat result from density, which rankedAcacia melifera as first in terms ofgrowth speed of,alsostudy provedthat there aresignificant differencesin the production ofbiomass.WhereAcacia Senegalcameinsecond stage,as well asvariedbiomassproducedfrom the roots ofseedlings.Also thestudy provedthat there aregreat similaritiesbetween theAcaciaSenegal and Acacia meliferain somequalitiesin terms of growth, height, dry weight and number of leaves.

7. RECOMMENDATIONS

- The study recommended that mustuseappropriatedensityperarea depending on thetargetof agriculture. Increasedthe distance andreduce the number ofseedlingsper areahelp in decreasing

thecompetitionbetween species andto increase theproductionofbiomass.

- The study recommendedfurther researchesand studieson theeffect ofplant densityon the general characteristics ofthe tree growthin general,so as tofollow the development ofgrowthand evaluate theirproducts.

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