

## Yield Performance Of Alfalfa Varieties In Afgoye District

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### Abstract:

**Background:** This study was carried out NUUN-GARE Agricultural village, lower Shabelle, Somalia. The experiment was conducted on four Alfalfa varieties with the use of Randomized Completely Block Design "RCBD" with three replications and four varieties. The total numbers of the experimental plots were 12 plots; Parameters such as plant height and fresh yield were measured for the varieties in three different cuts or harvests. Results in the first harvest (/cut) have shown that Hegazi variety have scored the highest plant height (65cm) while Aurora and Australia 2 have similar plant heights (53 cm). For fresh yield, Hegazi variety has revealed to comprise the highest fresh yield per hectare (44 ton/ha). Results from the second harvest have shown that Hegazi performed better than other varieties by giving plant height of 62 cm and fresh yield of 45 ton/ha. Similarly, results from the third harvest have shown that Hegazi have the highest plant height of 69cm and the highest fresh yield of 46 ton/ha. Recommendations are given to increase the test varieties to the maximum number possible, while introducing agricultural inputs in order to improve forage production and conservation in our indigenous land.

**Material and methods:** The study was conducted in Nuun-Gare Agricultural village which is about 25km from Afgoye district, Lower Shabelle region-Somalia, with Coordinates; Latitude (North) 2°11'16" and Longitude (East) 45°01'00", different zones over the region but there were conducted. The experimental farm had been surveyed during our thesis proposal operations in the middle of 2017. The techniques and methods we have used during of experimental program include; an experimental hectare was divided into large three blocks treated with irrigation by the river and somewhat the periodic precipitation was falling at that time in some area of the region. The design used for this experiment was Randomized Completely Block Design "RCBD" with 3 replications and four varieties by way of the total number of the experimental plots were 12 plots. So that, below table 1.1 has shown the layout for the experimental field design.

**Results:** Four varieties of Alfalfa forage crop were tested, including; (Cuff 101, Hegazi, Aurora, and Australia 2). The germination of all varieties was excellent, all plants germinated in 5 days, It took 60 days to harvest the plants at the first harvesting process and the plant height at harvest period was in the range of 55cm-65cm for Australia 2 and Aurora to Hegazi and Cuf 101,

All plants were harvested at ten percent (10%) flowering, just in improve the re-growth plants, and keep the highest nutrient content of the harvest. The deference in height and fresh yields be attributed to the genetically variations between the varieties since all of the agronomical practices for the whole varieties were alike; correspondingly the weeds were controlled manually with the use of hoes. The deference in height & fresh yield be attributed to the genetically variations between the varieties since all of the agronomical practices for the whole varieties were similar; also the weeds were controlled manually with the use of hoes. Three times were harvested commencing from September late up to late of November 2017, the yield increased steadily with the subsequent harvests as shown below figures and tables for the three harvests and made known the variations between plant height and fresh yields Tone Per Hectare (t/ha), In addition, the data was analyzed by a software called Microsoft Office Excel, tables and figures were accessible by representing the report terms and the results from the variety trials (Or experiments) were shown below subsequent harvests.

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### I. INTRODUCTION

Alfalfa (*Medicago sativa L.*) appears to be the only forage crop which was cultivated before recorded history, a distinction that limits the accuracy with which its origin can be deduced. Most authorities generally agree that Alfalfa probably originated in Persia (an arid region which is now mainly Iran), (Bolton, 1949). (De Candolle, A.1902) stated that "Alfalfa has been found wild, with every appearance of an indigenous plant, in several provinces of Anatolia, to the south of the Caucasus, in several parts of Persia, in Baluchistan, and Kashmir." This general area of southwestern Asia would include the modern political divisions of Turkey, Syria, Iraq, Iran, Afghanistan, Pakistan, and Kashmir (Bolton, 1949).

From Persia this forage plant found its way to Arabia, where it was named, "Alfalfa", which simply means "the best forage" (Utah 1905) True Persia Alfalfa also spread to Greece in about 490 B.C. (Utah 1905) and later to the Roman Empire in about 200 B.C. The Romans made use of it in Italy and many other parts of the Mediterranean region (Bolton, 1949).

Concerning the spread of Alfalfa after its introduction into Italy, Bolton suggested that the Romans introduced Alfalfa into Western Europe when they invaded that area. However, with the fall of the Roman Empire and the advent of the Dark Ages, Alfalfa disappeared from Europe, or at least from the records. During this time it is thought to have been cultivated by the Arabs in the oases of North Africa (Bolton, 1949).

The introduction of Alfalfa into the New World began with the Spanish explorers and settlers of South America and Mexico. Early in the 16th century, the Spaniards conquered Mexico and Peru, introducing Alfalfa and other crops, From Mexico and Peru Alfalfa spread to Chile and Argentina in the 1600's and to Uruguay in 1776 (Fig. 1) (2), (Brough et al. "the historical diffusion of Alfalfa").

## II. MATERIAL AND METHODOLOGY

The study was conducted in Nuun-Gare Agricultural village which is about 25km from Afgoye district, Lower Shabelle region-Somalia, with Coordinates; Latitude (North) 2°11'16 ' and Longitude (East) 45°01'00'', different zones over the region but there were conducted. The experimental farm had been surveyed during our thesis proposal operations in the middle of 2017. The techniques and methods we have used during of experimental program; an experimental hectare was divided into large three blocks treated with irrigation by the river and somewhat the periodic precipitation was falling at that time in some area of the region.

### Experimental design for the variety trial:

The design used for this experiment was Randomized Completely Block Design "RCBD" with 3 replications and four varieties by way of the total number of the experimental plots were 12 plots. So that, below table 1.1 has shown the layout for the experimental field design.

**Table 1.1: Experimental layout**

R1	R2	R3
<b>Plot 1</b> Cuf 101	<b>Plot 5</b> Australia 2	<b>Plot 9</b> Hegazi
<b>Plot 2</b> Aurora	<b>Plot 6</b> Hegazi	<b>Plot 10</b> Australia 2
<b>Plot 3</b> Hegazi	<b>Plot 7</b> Aurora	<b>Plot 11</b> Cuf 101
<b>Plot 4</b> Australia 2	<b>Plot 8</b> Cuf 101	<b>Plot 12</b> Aurora

### Treatments and experimental procedures:

#### Soil properties and texture

The soil texture of the farm was clay soil, dark brown in color, with pH in of **6.5** appreciably while Alfalfa is preferred the neutral pH and the soil pH was tender in establishment period.

#### Field preparation machineries and methods

Our field preparation has been going on couple of days before seeding; perennial weeds were particularly competitive two weeks after sowing period, controlling weeds made easy to ensuring a long-lasting, productive stands. Besides the quack-grass and weeds were controlled manually with the use of hoes, The farm was prepared with the use of deep plowing in 20cm followed by disc and harrowing for proper soil suitability and seed bed preparation and plots sized with 7lx6w for proper irrigation purpose,

#### Sowing process and supplies:

Despite that, four varieties of Alfalfa were tested, including:

- 1) *Cuf 101*
- 2) *Aurora*
- 3) *Hegazi*
- 4) *Australia 2*

For establishment the field (1ha), divided into large plots sized with 7mx6m or (7 length and 6 width in each side), also used a traditional method of sowing manually drilled method of sowing intended for human force by applying seed drilling; "The method of sowing the seed in the correct depth and positioning them in the soil for covering them to a certain average depth,

The distance between plant rows were considered 20cm line by line and between plants were applied 12cm between each plant, by the way this method of planting ensured as to obtain high fresh yield performance.

Generally proper agronomic practices have adopted for all varieties by using a method of sowing called drilling in 20cm apart between rows.

**Seeding depth and rate of seed (kg/ha):**

Alfalfa is a small-seeded crop and correct seeding depth is very important. Seed should be covered with enough soil to provide moist conditions for germination while allowing the small shoot to reach the surface, Optimum seeding depths vary depending on soil types, Table 1.2 shown the depth and rate of seeds. The seeding rate based on a model of 25kg/ha, Plant seed (depth) 2cm in deep on fine clay soils, although all seeds were the same agronomical procedures.

**Table 1.2: Rate and depth of seeds for the varieties:**

Alfalfa varieties (Seeds)	Rate (kg/ha)	Depth (cm)
Cuf 101	25	2
Hegazi	25	2
Aurora	25	2
Australia 2	25	2

**Inoculant, Fertilizer and Insecticide agents:**

The sowing point of time Rhizobium bacteria were used to mix with the seed for create nodules on Alfalfa roots (nodulation), and allowing the bacteria to fix nitrogen where it becomes available to the plant, this will reduce the fertilizer use of the crop,

The *inoculant* treatment often contains *Apron fungicide* as well, which protects against diseases that reduce seedling emergence and also kill young seedlings.

Fertilizers were used for the variety trials, including: *Nitrogen (N)*, *Phosphor (P)*, *Potassium (K)*, and *Magnesium (Mg)*, rates was an amount of; 18-18-18+10 respectively, the techniques used for the solid fertilizers were established in a method called prodcasting on the whole farm, by applying human power (hands), Urea was applied at the rate of 100kg/ha at starting dose,

Also Malathion as applied as (Insecticide) for the control of Aphid and other insects at the rate of (2 liter/ha), the bellow table 1.3; shown fertilizer agents and weights. So that the bellow table 1.3 shown the agents used for the experiment and their rates.

**Table 1.3: Agents used for the experiment and their rates**

No	Agent	Usage	Rate
1.	Nitrogen (N)	Fertilizer app	18kg/ha
2.	Phosphor (P)	Fertilizer app	18kg/ha
3.	Potassium (K)	Fertilizer app	18kg/ha
4.	Magnesium	Fertilizer app	10kg/ha
5.	Urea	Fertilizer app	100kg/ha
6.	Malathion	Insecticide	2 l/ha
7.	Rhizobium Inoculants	//	50g/50kg of seed

**Sowing time for Alfalfa varieties in our indigenous:**

Alfalfa is cool forage crop that needs so much water, cool temperature and well prepared moisture, as well irrigation and land preparation, On earlier August 2017 was sown 4 varieties of Alfalfa forage crop to test their cultural practices as it was summer season on Somali condition,

In Afgoye district due to a greater chance of successful stand establishment, better growing conditions, such as a longer growing season, adequate soil moisture, and better irrigation water resource, enhance seed germination and establishment. Early summer seeding is preferred in some regions in Somalia because of the opportunity to establish Alfalfa is high after growing another crop.

**Irrigation method for the experiment:**

The system of irrigation was flood irrigation on plots by source of river whereas our experimental area was irrigated.

Alfalfa forage crop is also known to be more tolerant to reduced irrigation and water stress and commonly experience significantly fewer long-term effects on future production.

**Harvesting techniques and equipments:**

First cutting often is the most important cutting of the year, it usually produces good number of fresh yields and its forage quality changes fastest from day to day. Alfalfa started growing like traditional cereal crops in this summer, is almost kneeing high (50-65cm) in this place, and could be ready to cut soon.

As results shown, the 1<sup>st</sup> harvesting time was Late September 2017 by using a Machine called Sickle “*Manually, applying human power*”. Sickle really is a very slow and labor consuming device.

It could not be able to use harvesting machineries thought it is not available, and less financial support, by the way we applied the majority of technological activities by traditionally,

In general, the crop was harvested with the use of hand machine called Sickle, (or Bagging) hook is a hand-held agricultural tool designed with variously curved blades and typically used for harvesting, or reaping, grain crops or cutting succulent forage chiefly for feeding livestock.

**Measured parameters for the variety trial:**

This variety trails has been desired only to analyze the fresh yield (t/ha) and plant height (cm) between four varieties, moreover how they performed cultural practices since established in Afgoye.

On the other hand a competition was held for the varieties in order to compare the fresh yields and plant height between bellow varieties.

1. *Cuf101*
2. *Aurora*
3. *Hegazi*
4. *Australia 2*

A) Fresh yield ton per hectare (t/ha)

B) Plant height centimeter (cm). Seed rate (Kg), Irrigation and Variety were used normally, but not considered as agronomic parameters.

**Statistical analysis for the variety trial:**

The Variety trial was analyzed quantitatively despite that it is being premeditated the fresh yield (kg) and plant height (cm) by using normal scales for plant mass and plant height, in addition *Microsoft Office Excel 2007* were used to analyze the data..

### **III RESULTS AND DISCUSSION:**

**Results:**

Four varieties of Alfalfa forage crop were tested including; (*Cuff 101, Hegazi, Aurora, and Australia 2*). The germination of all varieties was excellent, all plants germinated in 5 days,

It took 60 days to harvest the plants at the first harvesting process and the plant height at harvest period was in the range of 55cm-65cm for Australia 2 and Aurora to Hegazi and Cuf 101,

All plants were harvested at ten percent (10%) flowering, just in improve the re-growth plants, and keep the highest nutrient content of the harvest.

The deference in height & fresh yield be attributed to the genetically variations between the varieties since all of the agronomical practices for the whole varieties were similar; also the weeds were controlled manually with the use of hoes.

Three times were harvested commencing September late up to late of November 2017, the yield increased steadily with the subsequent harvests as shown bellow figures and tables for the three harvests and made known the variations between plant height and fresh yields *Tone Per Hectare (t/ha)*,

In addition to that, the data was analyzed by a software called *Microsoft Office Excel*, tables and figures were accessible by representing the report terms and the results from the variety trials (*Or experiments*) were shown bellow subsequent harvests.

**Harvest 1: Data Presentation and Analysis:**

**Table 1.4: Plant height of the varieties for the 1<sup>st</sup> cutting (Centimeter):**

No	Varieties	Plant Height (cm)
1.	Cuf 101	63
2.	Hegazi	65
3.	Aurora	53
4.	Australia 2	53

The data accessible in Table 1.4 give details about the plant heights (cm) for the 1<sup>st</sup> harvest, it is mainly explains the four varieties, Cuf101, Hegazi, Aurora and Australia 2 and their rate of height in (cm). by the way this 1<sup>st</sup> harvest Aurora and Australia 2 was similar in height while Cuf101 and Hegazi considerably competitive furthermore awfully synonym, two digits was led by the Gegazi, Cuf101 reached 63cm in tall, Hegazi arrived at 65cm in height, Aurora and Australia 2 accomplished 53 in height, so that the above table go-over the main points and shown whole picture and concise for the whole gist.

**Table 1.5: Mean yield of the varieties for the 1<sup>st</sup> cutting (tone/ha):**

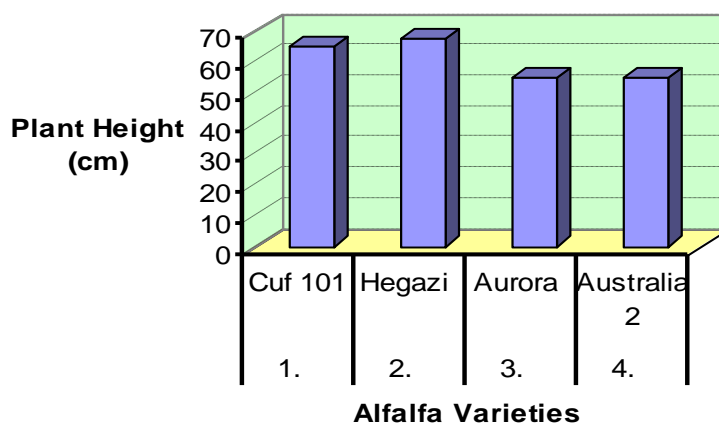
No	Varieties	Fresh yield (ton/ha)	Ranking
1.	Cuf 101	42	2
2.	Aurora	39.5	3
3.	Australia 2	39	3
4.	Hegazi	44	1

The data presented in Table 1.5 clears the mean yields for the varieties of the 1<sup>st</sup> harvest / cutting (tone per hectare “t/ha”), as it is mentioned we have hold fresh yield completion between 4 varieties, in this cutting Cuf101, produces 42 tons as fresh yields, and it was 3<sup>rd</sup> least variety in this cutting, Aurora produced for the 1<sup>st</sup> cutting 39.5 tons for fresh yields, Australia2 produced 39 tons of Alfalfa fresh yields, it was in middle ranging, and Hegazi produced 44 tons of Alfalfa fresh yields, it was the most favorable variety in every cutting, this variety was very tolerance in very location, because it was leading whole other 4<sup>th</sup> variety in every cutting,

In addition, Hegazi was leading the rank, it was number 1 variety for the variety trial, in Afgoye, Cuf101 was number 2 variety while Aurora and Australia2 were number 3 variety in ranking.

**Harvest 2: Data Presentation and Analysis:**

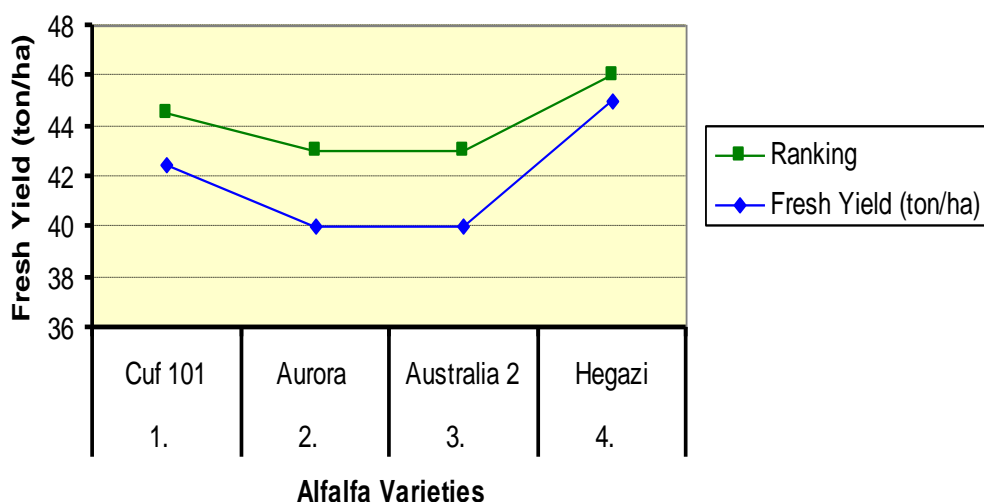
**Figure: 1.1: Plant height of the varieties for the 2<sup>nd</sup> cutting (Centimeter):**



According to the 2<sup>nd</sup> harvest; In October late 2017, although Alfalfa forage crop as a perennial animal feed, and the same time after the 1<sup>st</sup> harvest the field was incessantly irrigated to sustain the crop plant re-growth, all other agronomic requirements were similar as mentioned.

So, that inquiry for the 2<sup>nd</sup> harvest formed other variations between varieties for the 1<sup>st</sup> and 2<sup>nd</sup> as it was increased subsequently harvesting, *Australia 2* (Variety) and (*Aurora*) were also similar as where reached 52 cm, 52 cm as height in each variety respectively, but the *Cuf101* is under 2tons the *Hegazi* as they were shown 60 cm, 62 cm as plant height respectively, *Hegazi* leads the whole other varieties, since its the highest yield of Alfalfa varieties in every harvesting process for the whole samples in this variety trials.

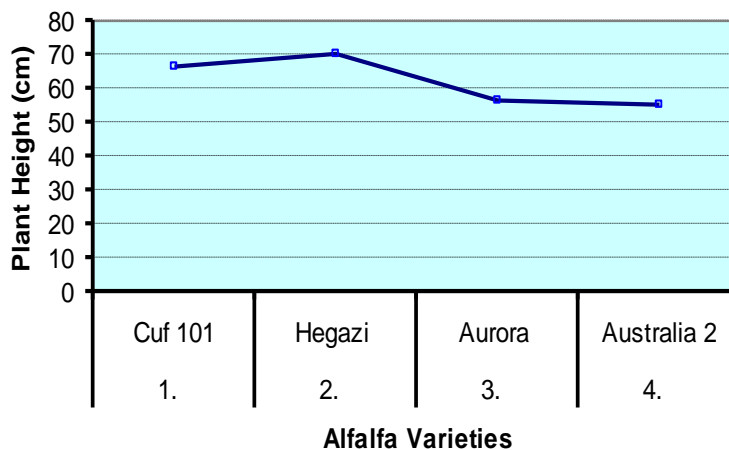
Figure: 1.2: Mean yield of the varieties for the 2<sup>nd</sup> cutting (tone/ Ha).



In addition, the above figure 1.2 has shown the mean yield of the varieties for the 2<sup>nd</sup> harvest (ton/hectare). In *October late 2017* as mentioned our previous figures, most of fresh Yield (t/ha) distinctions between varieties (*Cuf 101, Aurora, Australia2 and Hegazi*) were smaller and smaller although the yield performance have increased the subsequent harvests, each return (*Hegazi*) were the leader for the fresh yields and plant heights, the above figure 1.2 Cuf101 produced as fresh yield 42.3 tons, Aurora and Australia 2 were similar as they produced 40 tons while the Hegazi produced the highest yield rate 45 tons, it clear that Hegazi is still leading the other varieties. The rank in each or subsequent cuts were Hegazi number 1, Cuf101 became the 2<sup>nd</sup> variety while Australia 2 and Aurora were 3<sup>rd</sup> similarly.

**Harvest 3: Data Presentation and Analysis:**

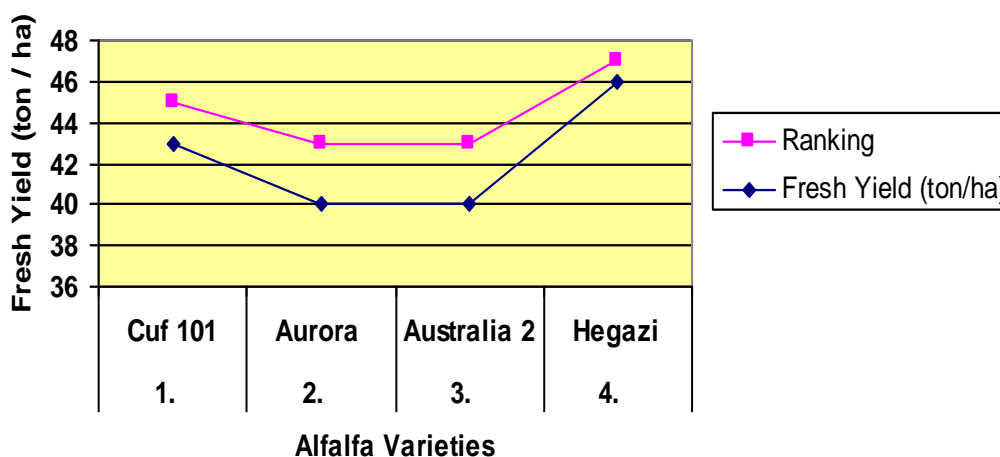
Figure: 1.3: Plant height of the varieties for the 3<sup>rd</sup> cutting (cm).



The over figure 1.3 shown the height of the varieties for the 3<sup>rd</sup> harvest or cut, Last put not least, on the late of *November 2017*, It has been harvested the most excellent plant height and fresh yields for the whole cultural practices on the variety trials, by the way, same agronomical practices were performed in at the whole cultivations .

In such way, the highest plant height for the variety trails was (*Hegazi*) as its height reached 69 cm, were the 2<sup>nd</sup> highest plant height in the whole cultivation was (*Cuf 101*) 66cm, while the (*Aurora*) and (*Australia 2*) were synonym 56cm, 55cm respectively ,

As well as when the plant samples (heights “cm”) were taken in any harvest actions there were no huge variations between varieties, but mostly (*Cuf101*) and (*Hegazi*) have got slight amount variations in height, e.g. (*Hegazi*) 2-3cm is typically longer than the (*Cuf101*) for the subsequent.

Figure 1.4: Mean yield of the varieties for the 3<sup>rd</sup> cutting (tone/ha).

In conclusion, the above figure 1.4 has shown the mean yield of the varieties for the 3<sup>rd</sup> cutting or harvesting, despite that in late of *November 2017* after plant heights (*cm*) were observed, we then gain the fresh yields (*t/ha*) for the varieties, as we normally carry on any agronomical practice in same way at whole cultural practices, like; *Irrigations management, Weeding control strategies, Insecticide, Disease Control, Harvesting,* and whole other cultural practices were similar during the 1<sup>st</sup> cutting up to 3<sup>rd</sup> cutting operations.

Despite that, (*Australia 2*) and (*Aurora*) were produced as fresh yields (*40 t/ha*) this could be the largest amount for fresh yield according the other earlier results, by the way (*Cuf 101*) also superior result according the hole other three harvests since it produced (*43 t/h*), in addition Hegazi performed a better result (*46 t/h*). So that, it is significant to know that the enlarge for the fresh yields in three times from the late *September* up to late of *November 2017*, and yield increased steadily with the subsequent harvests.

#### Discussion:

The performance of the Alfalfa varieties was in the range of 40–45 t/ha for each harvest which is equivalent to 40–45t/ha per annum when 10 harvest per year.

This yield encourages us to continue the test as long as, also some varieties in some parts of the world can be given up to 80 tones/ha. By the way the sowing date can be moved to November which is in the middle of autumn season.

Since we have tested only 4 varieties which is small in number, but we do recommend to increase the test varieties to the maximum number possible, as far as more suitable varieties can be identified with large number.

Despite that, since the crop is wet grown In Somalia and being livestock is maintain of Somali economy and Alfalfa is the most nutritious feed for livestock in the world, our yield (45t/ha) can be economic as far as it is not available in the county.

Alfalfa is cultivated in just some African countries located in northern and southern regions. Morocco grows nearly 106,000 ha (22.8% of country's total fodder crop land), with an average yield of 5.93 t DM ha<sup>-1</sup> (Daniel BASIGALUP et al 2014), on the other hand Algeria's alfalfa occupies about 10,000 ha, with a mean fresh yield production of 3 – 4 t DM/ha (John Irwin et al 2014), still discussing on some of the major alfalfa producers in African continents including Northern and southern regions, In Tunisia, alfalfa is the main forage and extends over about 13,000 ha “77% in oases” (Fugui Mi et al. 2014) while The small area planted in Mauritania is concentrated in oases. Alfalfa is the fourth forage crop in Egypt, where it reached 36,000 ha in 2008 all under irrigation. Locally adapted populations (landraces) are extensively used in Northern Africa oases, where alfalfa production is almost continuous (8-10 cuts year<sup>-1</sup>) and intervals between cuts are very short (Abdelguerfi et al 2002). South Africa is the main alfalfa growing country in the southern hemisphere, with about 300,000 ha (Mauriès 2003) mainly under irrigation, and where dairy cow diets contain up to 40% of Alfalfa hay.

Point of view Alfalfa cropping has potential for expansion in Africa, particularly under efficient irrigation systems (e.g. pivot irrigation) and with the development of dehydration units at the farm level. Also rainfed cropping of drought-tolerant germplasm in semi-arid regions has greater potential than hitherto believed (Annicchiari 2011). The evaluation and exploitation of local (Abdelguerfi 2004) and exotic (Annicchiari 2011) genetic resources has crucial importance for producing varieties with better tolerance to major stresses (e.g., Drought, Salinity, Heat) or to frequent cutting. The implementation of variety registration, reliable seed multiplication and commercialization chains are required in most countries for promoting adapted, improved varieties. Similarly in India, warm southern locations favour early flowering, while the opposite is the case in the north (Irwin 2001).

Finally we hope to continue like this experiment since it was an essential issue for our country despite the fact that the numbers of life stock rearing companies or intensification methods are increasing these recent years.

#### **IV. Summary, Recommendation and Conclusion for future researches:**

##### **Summary:**

The study examines the yield performance of Alfalfa varieties in Afgoye district lower Shabelle-Somali, it was intended to experiment the cultural practices for Alfalfa forage crop in our indigenous land, also it was intended to reflect the yield performance of the four varieties of Alfalfa in that area.

In addition, materials that have used for the experiment mostly were disc and harrowing for the primary and secondary tillage occupation and for proper soil suitability and seed bed preparation, we have used main two methods of sowing including; a) Prodcasting by human power ‘hands’ in some varieties and b) drilling by applying human power mechanical sowing were not used for financial harms and less developing technology in our county ‘‘Somalia’’, Sickle or manually harvested machine were used to cut the whole harvests, the main agronomical parameters intended for the experiment two Plant height (cm) and fresh yield (ton /ha) in order to collect the data in an schedule design table.

Finally we have harvested three times for the crop and each 1<sup>st</sup> harvest considerable increasing to the next cut, by the way we have range of 40-45 ton/hectare for fresh yield in each harvest which is equivalent to 40-45t/ha per annum when 10 harvest per year. So that this could be highlighted to continue sorts of tests like this, because of Somalia are plenty of agricultural land with best irrigations sources that allow forage planting.

##### **Recommendations:**

- We do recommend to increase the test varieties to the maximum number possible
- Though we tested the most nutritious forage crop ‘‘Alfalfa’’, and better result have got, we do recommend to take care Irrigation problems although it was the greatest aspects for production of forages, so irrigation managements required and cover necessitates for irrigation systems and scheduling by holding workshops.
- We do recommend introducing agricultural inputs in order to improve forage production and conservation in our indigenous land.
- Agricultural facilities should be provided the Somalia Agro-pastoralists and should be trained them for holding a simple workshops or seminars
- We recommend broadcasting agricultural knowledge and (Modern agricultural systems) to improve the quality and quantity of yields and get better performance stage.
- We also do recommend helping Somali farmers in rehabilitations of poor canals and dams and also supplying of sufficient water for all of the irrigated areas.
- Also we recommend to provide good marketing for the fresh forage yields and to manage it after harvested for long time preservation.
- There is need for support rural infrastructure on forage production fields, education, provision of forage production and conservation and other facilities.
- Also it could be highlighted to continue sorts of tests like this, because of Somalia are plenty of agricultural land with best irrigations sources that allow forage planting.

##### **Conclusion:**

The production of Alfalfa provides greater economic opportunities that are beneficial than any other forage crops can offer. However, there are still considerable areas associated with best soil performance and suitable this crop production where improvements should be made in order to reduce the import or consumption of the entire exotic animal feeds from abroad.



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