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Prospective of Agroforestry System for Forage Production in Arid Land of Saudi Arabia

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Abstract: Arid land constitute a large proportion of arable land in Saudi Arabia. These land are characterised by low and unreliable rainfall and low land productivity. Comparative study was carried out to evaluate forage production under agroforestry system comparing with the production in conventional agriculture. Ziziphus trees as adapted species to arid land were used in agroforestry system with three forage crops namely, Alfalfa, blue panic and clitoria. The experiment was run for six month, crops yield was taken six times. The results showed that the production of all three forage crops was increased considerably over the production in the conventional agricultural system.

Keywords: Agroforestry, forage crops, arid land, ziziphus trees, conventional agriculture.

INTRODUCTION

Semi-arid lands are characterized by low soil fertility, low rainfall and limited availability of surface and ground water and high levels of soil erosion that greatly affect and limit agricultural production[1]. In Kingdom of Saudi Arabia Most of the land area are either arid or semi-arid, with very limited forest cover[2]. Most of these areas receive in average less than 100 mm rainfall per annum. The western part of the country represents one of the drier parts which falls within hyper arid, arid or semi-arid lands. In addition to this limited amount of rainfall, there is considerable depletion of ground water resources. Thus, sustainable integrated crop production systems that maximize land use need to be developed.

Agroforestry is considered to be an alternative land use system in arid lands that can achieve this goal[3]. In its simplest form, agroforestry can be defined as a sustainable land use management system, in which trees and/or shrubs are deliberately combined with crops and/or livestock to maximise positive interactions between tree and non-tree components.[4] Agroforestry system is used to enhance or diversify farm products, reduce surface water runoff and erosion, improve utilization of nutrients, reduce wind erosion, modify the microclimate for improved crop production, improve wildlife habitat, and enhance the aesthetics of the area. Trees or shrubs are generally planted in a single- or multiple-row set or series. The spacing between sets is determined by the primary purpose of the cropping system and the agronomic, horticultural, or forage crop grown. Shrubs are typically selected for their potential value for wood, fruit crops and/or for the benefits they can provide to the crops grown in the system. There are many compatible species, depending upon region of the country, value, and markets. All traditional crops can be grown with agroforestry system. The primary factors determining which crops can be grown are the canopy density and sunlight requirement for the crop.

The import of forage crops from abroad to Saudi Arabia is costing a lot and there is urgent need for local production. The harsh climate is another limiting factor for local forage production in the country. The present study aimed to evaluate the production of forge crops under the agroforestry system of ziziphus trees comparing with conventional production.

MATERIALS AND METHODS

Location of the experiment: A field experiment was conducted at the Agricultural Research Station, King Abdulaziz University, at Hada Al-Sham during the 2013 and 2014 seasons.

Experimental unit size: The experimental plot size was 7 m long and 2 m width, with 20 cm row spacing in alfalfa and blue panic and 40 cm in clitoria.

Experimented forage crops:

Blue panic: Blue panic (*Panicum antidotale Retz*.) is a vigorous, perennial grass forge crop. The crop can yield high fresh and dry forge under the none stress and stress conditions[5]. The studied cultivar was the Australian Gold-10 Cultivar.

Butterfly pea: Butterfly pea (*Clitoria ternatea*L.) is a vigorous, strongly persistent, herbaceous perennial legume. It is easy to establish, high nutritional value, good for fertility restoration, high forage and seed production and Moderate tolerance of salinity and sodicity. The local Sudanese cultivar was used.

Alfalfa: Alfalfa (*Medicago sativa*) is a perennial legume, and it is the main forge crop in Saudi Arabia .Alfalfa is a moderate tolerance of salinity stress[6]. Cuff 101 cultivar was used.

Experimented Tree species:

Jujube: Jujube (*Ziziphusjujube*) is a small deciduous tree or large shrub. It was first cultivated in China for its fruit over 4000 years ago. Easily grown in average, medium moisture, well-drained soils and dry climates in full sun. Plant is tolerant to alkaline soils. Mature plants have some tolerance for drought stress.

Irrigation system: Surface applied drip irrigation system was installed for irrigation application. Pipes were laid out at 20 cm apart and dripper were 9 cm apart. All three forages (alfalfa, blue panic and clitoria) were planted in 20 cm apart lines for alfalfa, blue panic and 40 cm for clitoria.

RESULTS AND DISCUSSION

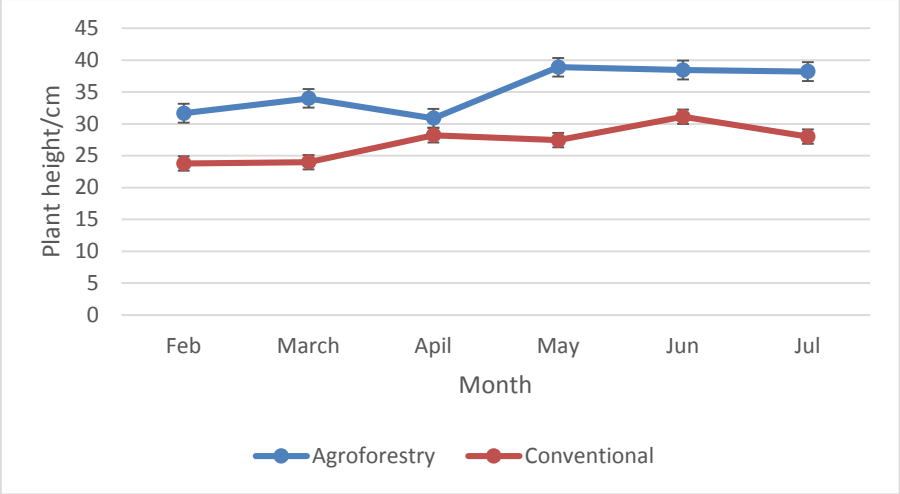

Figure 1: Alfalfa plant height

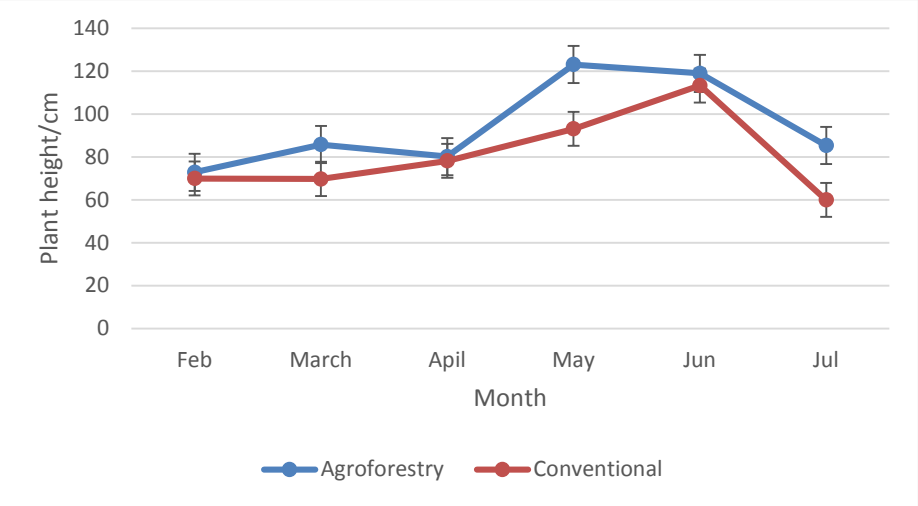

Figure 2: Blue panic plant height

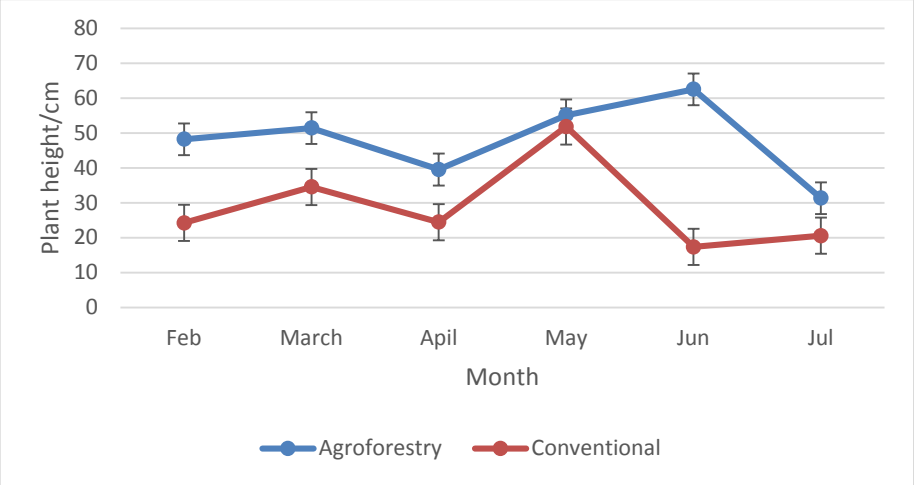

Figure 3: Clitoria plant height

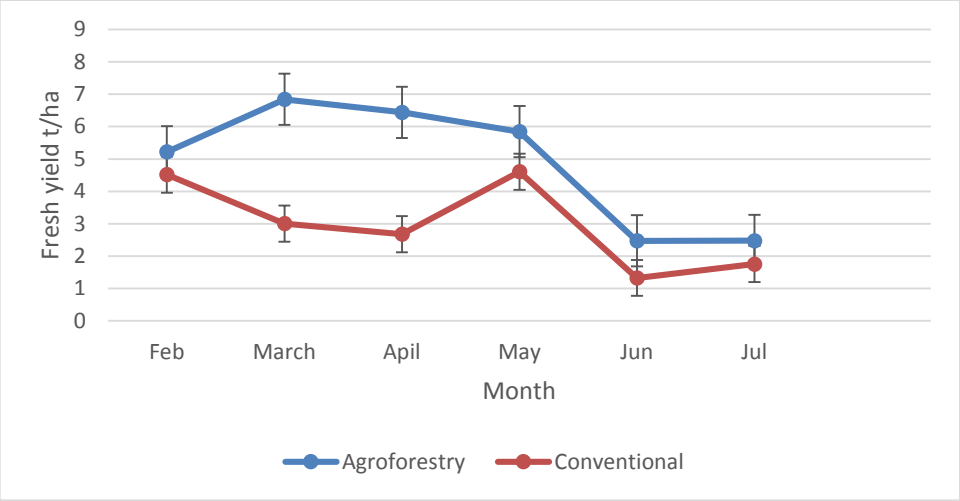

Figure 4: Alfalfa fresh yield

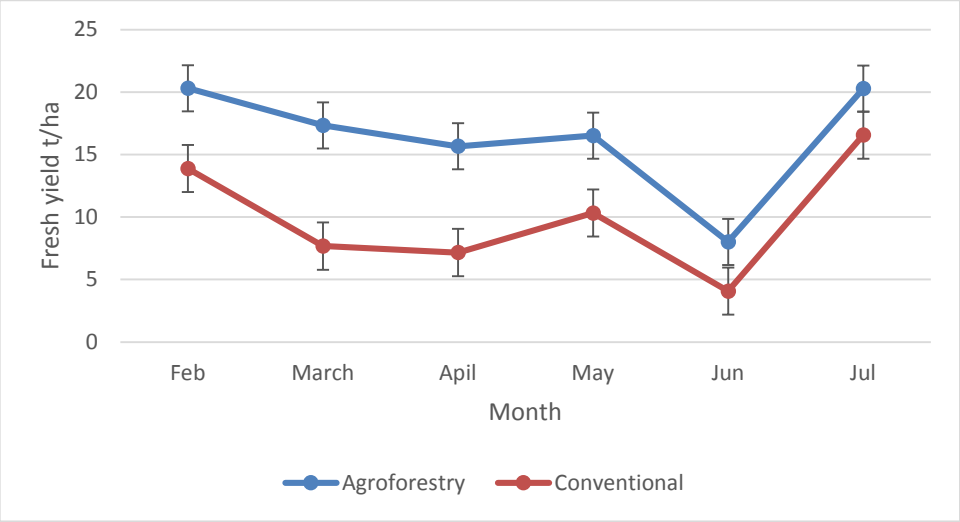

Figure 5: Blue panic fresh yield

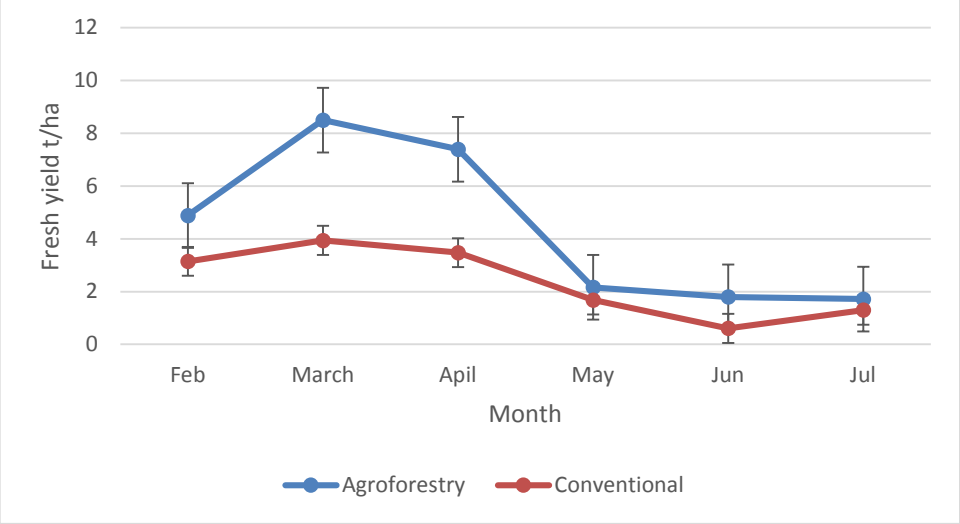

Figure 6: Clitoria fresh yield

Figure 7: Ziziphus tress lines before the cultivation

Figure 8: The forage crops during growth stage

Figure 9: Agroforestry system after forage crops cutting

The results of Alfalfa, blue panic and clitoria showed that the crop performance was much better than the control. Investigated crops showed higher plant height than the control. The crops yield was increased considerably than that recorded by conventional system. This result is in agreement with several studies which evidenced the advantage of agroforestry. Atta-Krah and Sumberg[7] reported that Gliricidia sepium alley cropping system in alfisol soil in Nigeria gave 2.42 t/ha of maize while control plots yielded 1.74 t/ha. The effect of agroforestry on yield production of forage crops is contradicted according to agroecological zones .Singh et al.,[8] reported that the yields of castor , cowpea and

sorghum alley cropped with leucaena hedgerows were lower than the yield in the control treatment. An important benefit of agroforestry system in arid land of Saudi Arabia in case of ziziphus trees and forage crops is microclimate because of wind erosion and high temperature. The addition of large amounts of organic materials from the monthly crops cuttings and reduction of the use of chemical fertilizers to avoid salinization is another advantage that should be considered.

CONCLUSION

The findings of the study confirmed the significant role of agroforestry system in improving the yield of forage crops. Ziziphus tree is a good choice for the system due to its rapid growth rate and ability to withstand environmental stresses such as drought and high soil salinity. Further studies on investigating new leguminous trees and other forage crops should be carried out.

REFERENCES

1. Pessarakli M. and Szabolcs I, 2010. Soil salinity and sodicity as particular Plant/Crop Stress Factors. In:Pessarakli, M. (Ed.), Handbook of Plant and Crop Stress. 3rd Edn., Revised and Expanded, CRC Press, Tylor and Francis Publishing Co., Florida, pp:1173.
2. FAO, Highlands and Drylands, Mountains, a source of resilience in arid regions. 2011, 1-115.
3. B. Jama and A. Zeila, Agroforestry in the drylands of eastern Africa: a call to action. ICRAF Working Paper – no. 1. Nairobi: World Agroforestry Centre. 2005.
4. M. Gold and Mson, Defining agroforestry. In manual for applied agroforestry practices. Gold M, Cernusca M and Hall M (eds). The Centre for Agroforestry, University of Missouris, USA, 2013.
5. F.S. El-Nakhlawy, S. Ismail and J. Basahi, Forge Yield and water use of Alfalfa (Medicago Sativa L.) and Blue Panic (Panicum antidotale Retz.) irrigated with saline water in surface and subsurface drip irrigation systems. Wulfenia, 2015, 22(2):110-123.
6. F.S. El-Nakhlawy, M. Shahen and A. Alshareef, Response of forge yield, protein and praline contents of alfalfa genotype to irrigation water salinity and phosphorus fertilization , J. Food Agric Environ. 2012, 10: 551-557.
7. A.N. Atta-krah and J.E. Sumberg, Studies with Gliricidia sepium for crop/livestock production systems in West Africa proceedings of workshop held at CATIE, Costa Rica. NFTA Special publication 1988, 87-01, 31-43.
8. M.D. Singh, C.K. Ong and N. Saharan, above and blew ground interactions in alley cropping in semi-arid India. Agroforestry systems 1989, 14, 219-231.

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