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Coffee (*Coffea arabica* L.) Nursery Soil Amendment Research on Acidic Soil of South western Ethiopia - A Review

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Abstract

Despite the existence of enormous coffee genetic diversity and importance of the crop in the national economy of the country, its production potential hardly exceeds 0.7 t ha^{-1}. Such a low productivity of the crop mainly stems from drought, inadequate or excessive light or shade, low soil fertility and undulating topography and associated factors, such as soil erosion and soil acidity. In addition, coffee cultivation mainly lies on the production of coffee seedlings with desirable characteristics under the recommended nursery management operations. Because any improper handling made at the early stage would remain to cause poor field performances and life span of coffee trees in the field. Recognizing the problem, several nursery soil amendment researches have been conducted aiming to ameliorate acidic nursery soil and promoting quality coffee seedling production for field planting in acidic soil of south western Ethiopia. Therefore, outstanding research achievements generated so far pertaining to coffee nursery soil amendment in south western Ethiopia are reviewed and briefly presented in this paper.

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Keywords

Amendment, Arabica coffee, Coffee seedlings and Nursery management.

Introduction

Coffee (*Coffea arabica* L.), originated in Ethiopia, is the second major traded commodity following to oil (Zelalem, 2013) and thus plays a vital role in the balancing of trade between developed and developing countries. Coffee is an important foreign exchange commodity, contributing in various degrees to the national income of the producing countries (Patricia, 2011).

Coffee guarantees a solid basis for promotion of economic development of the producing countries. About 33 million people in 25 African countries derive their livelihoods by growing coffee on their subsistence farms and particularly, in Ethiopia 15 million people directly or indirectly deriving their livelihoods from coffee system (Gray *et al.,* 2013). Ethiopia is the largest producer of coffee in Sub-Saharan Africa and is the fifth largest coffee producer in the world next to Brazil, Vietnam, Colombia and Indonesia, contributing about 7-10% of total world coffee production (Gray *et al.*, 2013). Despite the existence of enormous genetic diversity and importance of the crop in the national economy of the country, its production potential hardly exceeds 0.67 t.ha-1 (CSA, 2016). Such a low productivity of the crop mainly stems from drought, inadequate or excessive light or shade, low soil fertility and undulating topography and associated factors, such as soil erosion and soil acidity (IAR, 1996; Yacob *et al.,* 1996; Solomon *et al.,* 2008; Anteneh *et al.*, 2015; Bikila, 2021). In addition, coffee cultivation mainly lies on the production of coffee

seedlings with desirable characteristics under the recommended nursery management operations. Because any improper handling made at the early stage would remain to cause poor field performances and life span of coffee trees in the field (Anteneh *et al.*, 2015; Bikila, 2021).

Recognizing the problem, several nursery soil management researches have been conducted aiming at promoting quality coffee seedling production for field planting in the country. Therefore, outstanding research achievements generated so far pertaining to coffee nursery soil amendments in Southwestern Ethiopia are reviewed and briefly presented in this paper.

Research Findings

Nursery media

Coffee seedlings can be grown on raised beds (15 cm height) or in polythene tube (10 -12 cm diameter and 22.-25 cm height) filled with forest soil collected from the top 5 -10 cm depth. However, in the absence of forest soil (FS), it was recommended to use blends of top soil (TS) and compost (C) only or TS, C and sand (S) following the order of 3TS : 1C : 0S > 2TS :1C 1S > 2TS : 2C : 0S > 6TS : 3C :2S (Figure 1).

Likewise, Taye (1998) revealed that a mixture of locally available organic manure and TS in 1 : 4, 2 : 4 and 3 : 4 ratios had promoted both shoot and root growth of coffee seedlings. However, if this media blends are suspected to be low in plant nutrients, addition of 2 g DAP/seedling after the seedling attain two pairs of true leaves would improve seedling growth (Taye, 1998).

Nursery Soil Amendment

Nursery experiment was conducted at Jimma Agricultural Research Center to evaluate the effects of lime and phosphorus rates on growth of coffee seedlings under nursery conditions. Accordingly, it has been reported that integrated application of 0 g lime and 750 mg P/pot (2.5 kg sieved top soil) and 2.31 g lime and 250 mg P/pot produced coffee seedlings with higher shoot and rot dry matter yield (Figure 2a and b). This was primarily associated to the rise in soil pH and precipitation of the exchangeable aluminum that fixes phosphorus (P) and increase in solubility and availability of soil phosphorus (P) to the seedlings (Anteneh and Heluf, 2007).

Furthermore, result of similar experiment conducted on hybrid coffee on the nursery at Jimma Agricultural Research Center revealed that the interactions of lime and phosphorus(P) rates significantly increased stem, leaf and root dry matter of hybrid coffee seedlings. The interaction of 10 g lime and 800 mgP/pot (2.5 kg top soil) rate promoted the dry weight of hybrid coffee seedlings.

However, application of lime above 10 g/pot adversely affects seedling growth and nutrient availability (Figure 3a, b and c). Hence, it was recommended that combined application of 10 g lime and 800 mg P/pot enhances the optimum growth of hybrid coffee seedlings under nursery conditions (Ewnetu *et al.*, 2019).

Similarly, in the evaluation of the response of Wollega coffee selection seedlings growth in response to the incorporation of lime and coffee husk compost amendments on acidic soil at Haru Agricultural Research Center, west Wollega, found that application of lime and decomposed coffee husk (DCH) and their interactions were enhanced stem leaf and root dry matter of coffee seedlings.

Accordingly, application of 18.75 g/pot decomposed coffee husk and combined application of 4 g/pot lime and 12.5 g/pot decomposed coffee husk could be a promising alternative amendment for acid soil management and production of vigorous coffee seedlings in Haru areas (Figure 4a, b and C).

Soil acidity is a problem in the country's coffee growing regions. As a result, enriching nursery medium with a combination of lime, Phosphorus mineral fertilizer, and compost may be a viable alternative amendment for acid soil management and the production of robust coffee seedlings for field planting.

Fig.1 Effect of different media composition on dry matter production of coffee seedlings. TS = Top soil. C = Compost and S = Sand. **Source:** Anteneh *et al.*, (2015).

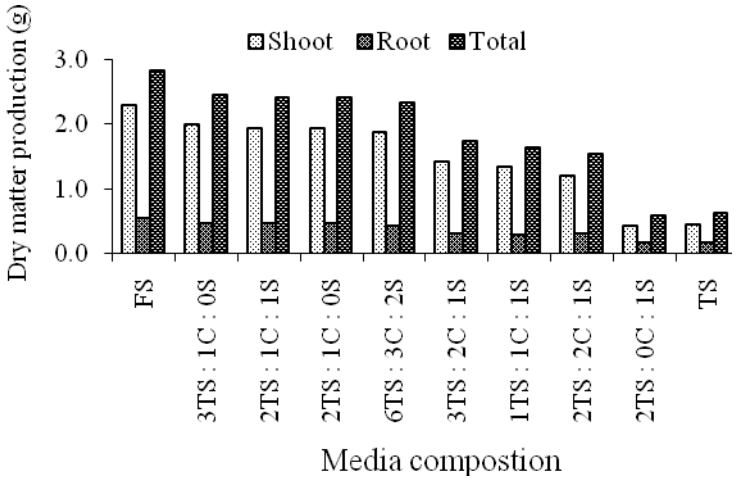


Fig.2 Effects of interaction of lime and P rates on shoot (a) and root (b) dry matter of coffee seedlings. **Source:** Anteneh and Heluf (2007).

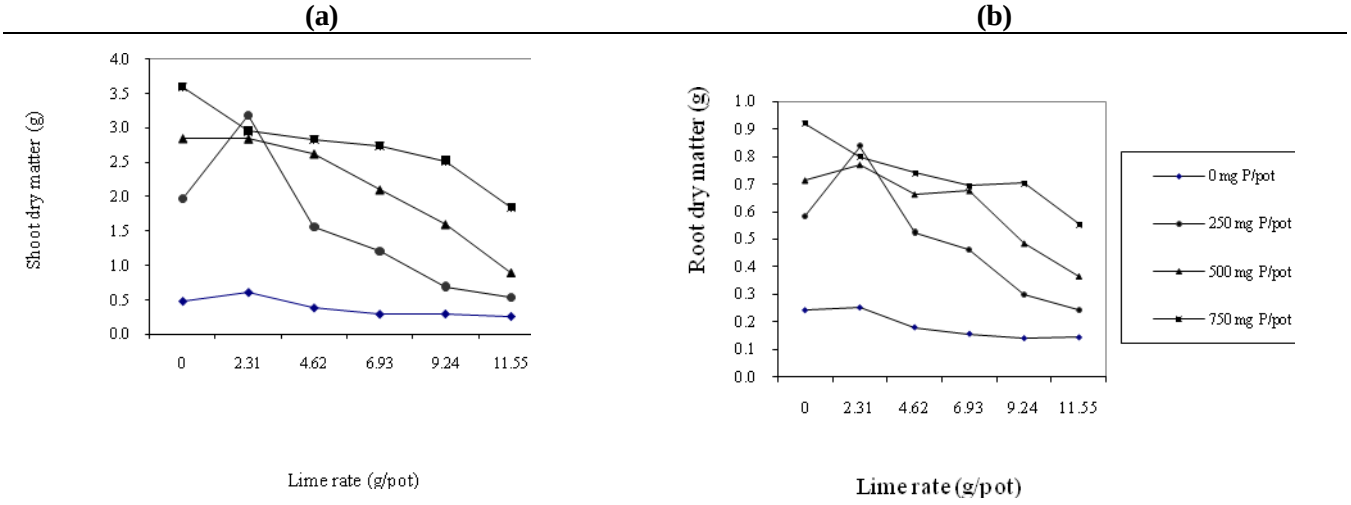
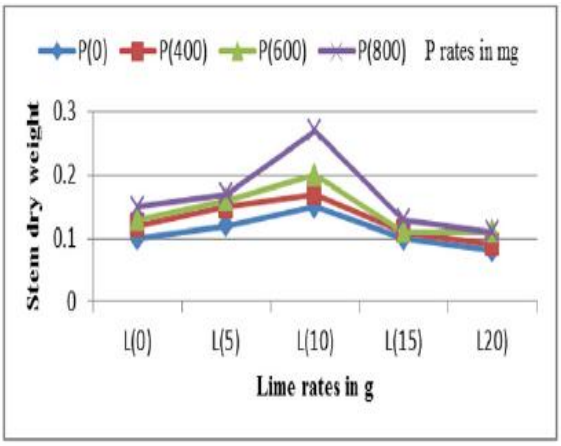


Fig.3 Effects of interaction of lime and P rates on stem (a), leaf (b) and root (c) dry matter of hybrid coffee seedlings at Jimma. **Source:**Ewnetu *et al.*, (2019).

a



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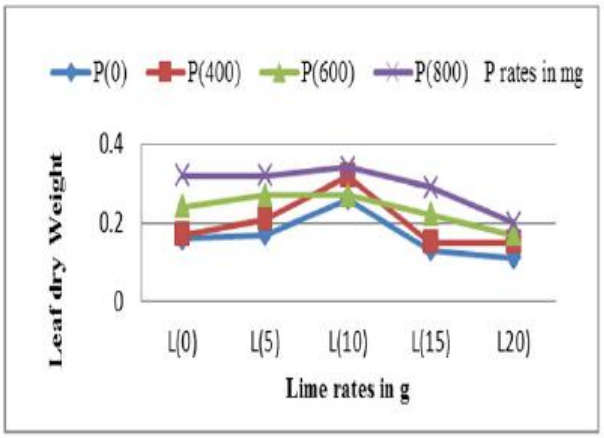

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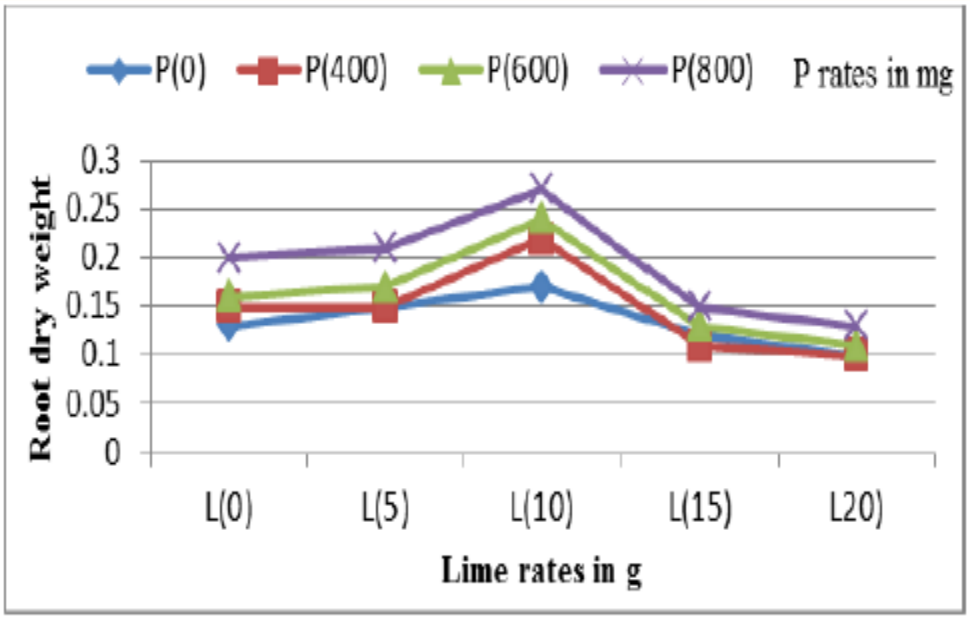
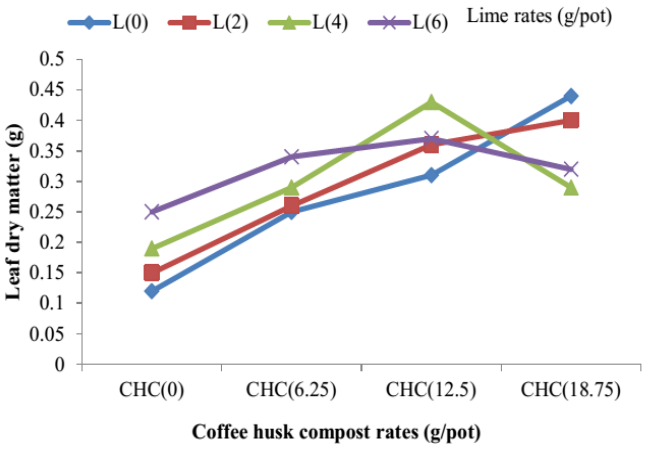
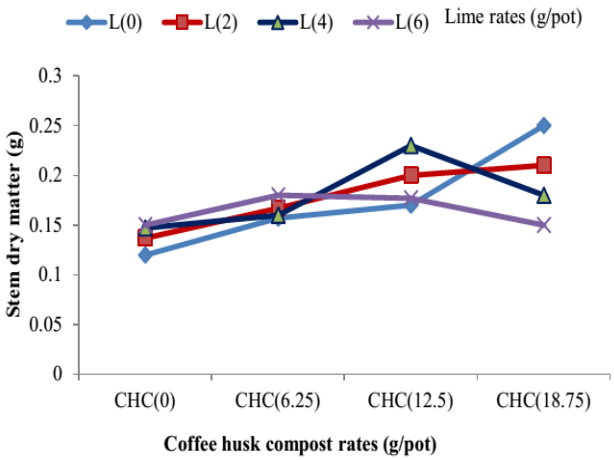


Fig.4 Interaction effects of lime and coffee husk compost rates on stem (a), leaf (b) and root (c) dry weight of coffee seedlings. **Source:** Bikila *et al.*, (2020)

a



b



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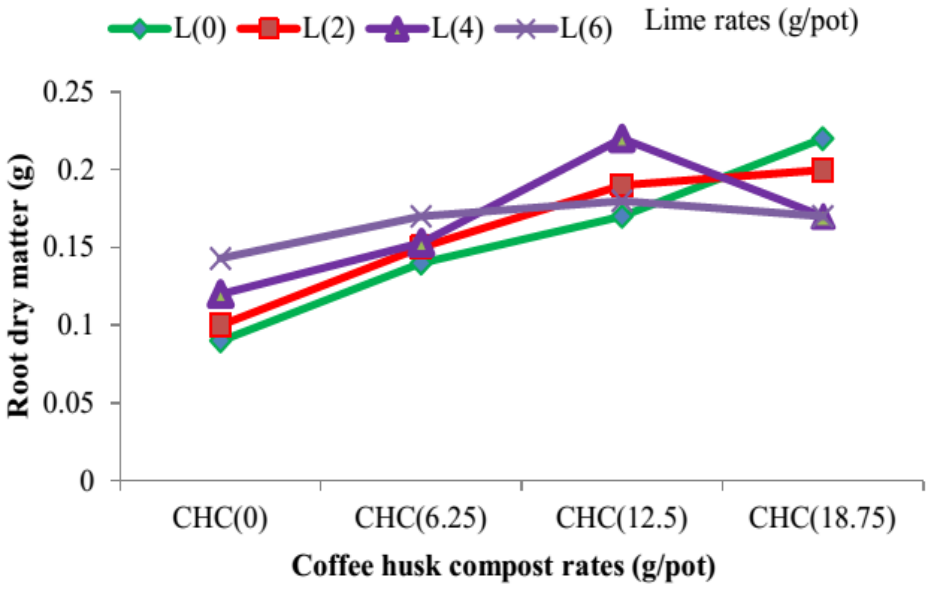

References

Anteneh N. 2015. Response of Coffee (*Coffea arabica* L.) Seedlings to Lime and Phosphorus Mineral Fertilizer at Jimma, Southwestern Ethiopia. Journal of Biology, Agriculture and Healthcare, 5 (13): 27-32.

Anteneh N. and Heluf G. 2007. Response of Arabica coffee seedling to lime and phosphorus: II. Dry matter production and distribution. p. 1095-1100. In: International Conference on Coffee Science, 21, Montpellier, 11– 15September 2007. ASIC, France.

Anteneh N., Taye K. and Tesfaye Sh. 2015. Review of Arabica Coffee Management Research in Ethiopia. Journal of Biology, Agriculture and Healthcare, 5 (13): 235-258.

Bikila T., Taye K. and Alemayehu R. 2020. Effects of lime and coffee husk compost on growth of coffee seedlings on acidic soil of Haru in Western Ethiopia.*Journal of Degraded and Mining Land Management.* 8(1): 2391-2400.

Bikila, T. D. 2021. Dry Matter Yield and Nutrient Uptakes of Wollega Coffee Seedlings as Influenced by Lime and Coffee Husk Compost Amendments at Western Ethiopia. *Pelita Perkebunan (a Coffee and Cocoa Research Journal),* 37(2): 97-106.

CSA (2016). Report on Area and Production of Major Crops. Private Peasant Holdings, 2016/17 Meher Season. Volume 1. Central Stastical Agency, Ethiopia.

Ewnetu, T., Taye, K. and Alemayehu, R. 2 019. Effects of lime and phosphorus rates on growth of hybrid arabica coffee seedlings at Jimma, Southwest Ethiopia. Journal of Biology, Agriculture and Healthcare 9(15):37-46.

Gray, Q.; A. Tefera & T. Tefera (2013). Ethiopia: Coffee Annual Report. GAIN Report No.ET-1302, GAIN Report Assessment of Commodity and Trade by USDA, USA.

Institute of Agricultural Research (IAR) 1996. Recommended production technologies for coffee and associated crops. Addis Ababa, Ethiopia. 17 pp.

Patricia, F., 2011. The Coffee Exporter's Guide.3rd eds., International Trade Centre, Geneva. 247pp.

Solomon Endris, TesfuKebede, Tesfaye Yaekob, YaredKassahun and Jafar Dawid. 2008. The Challenges and Opportunities of Organic Fertilizers in Coffee. 226-233. In: Coffee Diversity and Knowledge (Girma Adugna; BayettaBelachew; Tesfaye Shimber; EndaleTaye. and TayeKufa. ed.). Proceedings of National Workshop Four Decades of Coffee Research and Development in Ethiopia, 14-17 August 2007, Addis Ababa (Ghion hotel), Ethiopia.

Taye K. 1998. Response of Arabica coffee (*Coffea arabica* L.) to various soil fertility management. Thesis presented to the school of graduate studies Haramaya University of Agriculture. In partial fulfillment of the requirement for the degree master of science in agriculture (agronomy), Haramaya, Ethiopia.137 pp.

Yacob E., Tesfaye Sh., Alemseged Y., Anteneh N., Takele N., Mohammednur A. and Bekele B. 1996. Advances in coffee agronomy research in Ethiopia. p. 40-45. In Proceedings of Inter Africa Coffee organization (IACO) Workshop, 4-6 September 1995, Kampala, Uganda.

Zelalem B. 2013. Effect of maize Stover application as soil mulch on yield of Arabica coffee (*Coffea arabica* L., Rubiaceae) at Western Hararghe Zone, Eastern Ethiopia. Sustainable Agric. Res., 2: 15-21.

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