Crop Protection xxx (2016) 1–8

Contents lists available at ScienceDirect

Crop Protection

journal homepage: www.elsevier.com/locate/cropro

Does intercropping play a role in alleviating weeds in cassava as a non-chemical tool of weed management? – A review

L.V.Y. Weerarathne [a, *], B. Marambe [a], Bhagirath S. Chauhan [b]

[a] Department of Crop Science, Faculty of Agriculture, University of Peradeniya, 20400, Sri Lanka
[b] Queensland Alliance for Agriculture and Food Innovation (QAAFI), The University of Queensland, The University of Queensland, Toowoomba, Queensland 4350, Australia

ARTICLE INFO

Article history:
Received 5 April 2016
Received in revised form
20 August 2016
Accepted 25 August 2016
Available online xxx

Keywords:
Cassava
Intercropping
Competition
Weed control
Compatibility

ABSTRACT

Cassava is an important root and tuber crop in the tropics which requires intensive weed management at its early growth stages. This review emphasizes the potential of exploiting the option of intercropping as a non-chemical tool of weed management in cassava. The appropriateness and the significance of including intercropping solely and as a component of an integrated weed management system in cassava are further discussed. Literature suggests that intercropping is a successful option in managing weeds when the spatial and temporal compatibility of intercrop combinations is being achieved. In widespread cassava-based intercropping systems, intercropping itself has proven its ability to alleviate weeds up to 30–60%, or even up to 100% with the selection of a better compatible crop mixture such as the cassava-pumpkin intercrop combination. A number of studies conducted to ascertain the appropriate spatial and temporal compatibility levels of many intercrop combinations have provided evidence of their weed suppressive ability in cassava-based intercropping systems. The focus of such studies towards the basic agronomic, physiological and biochemical determinants of crop-weed interactions seems rather constricted. In conclusion, intercropping is suggested to be exploited as an effective weed management tool in cassava preferably through further research, prior to endorsing it as a proper alternative to chemical weed control measures, especially for the resource–poor farmers who probably can neither afford herbicides nor labour-intensive cultural methods for weed management.

1. Introduction

Cassava (*Manihot esculenta* Crantz) belongs to the group of tropical root and tuber crops and ranks next to cereals in importance, particularly in tropical regions (Lebot, 2009; Owusu-Darko et al., 2014; Villordon et al., 2014). Cassava is an important source of food and nutrition for many of the poorest and the most undernourished population living in Africa and Asia (Scott, 2000). It is among the top 10 food crops of the world in terms of its annual volume of production in developing countries over other tropical root and tuber crops (Srinivas, 2009; Tavva and Nedunchezhiyan, 2012). Of the total cassava production in the world, 30–60% is produced in Africa, 30–40% in Asia, and 15–20% in Latin America (El-Sharkawy, 1993; FAO, 2015). Although 50% of the total area planted to cassava is in Africa, the yields are lower than in Asia and Latin America due to various reasons.

Adaptation of cassava to marginal environments, its contribution to household food security, and its great flexibility in intercropping systems make it an important crop for resource-limited farmers (Horton, 1988; Labrada et al., 1994; Reddy, 2015). According to the estimates made by the Consultative Group for International Agricultural Research (CGIAR), over two billion people among the farming community in Asia, Africa, and Latin America will use root and tuber crops including cassava for food, feed, and income generating products beyond the year 2020 (FAO, 2012; Scott, 2000). However, the production and productivity of cassava are adversely affected by the presence of weeds (Korieocha, 2014; Labrada et al., 1994; Lebot, 2009; Melifonwu et al., 2000; Moody and Ezumah, 1974; Nedunchezhiyan et al., 2013). Crop-weed competition is determined by growth habit of the crop where a rapid canopy cover of a crop suppresses weed population. Cassava is a long-duration crop with a slow growth and canopy development rate at its initial growth phases (Amanullah et al., 2006, 2007; Hillocks et al., 2002; Olasantan, 2001, 2007). It is usually grown in wide-spaced

* Corresponding author.
E-mail address: vishnaweerarathna@gmail.com (L.V.Y. Weerarathne).

http://dx.doi.org/10.1016/j.cropro.2016.08.028
0261-2194/

rows at 0.5–1.5 m × 0.5–1.5 m (El Bassam, 2010; Howeler, 2001; Streck et al., 2014) thus, allowing weeds to thrive well (Horton, 1988; Howeler, 2000; Leihner, 1983; Mutsaers et al., 1993; Nedunchezhiyan et al., 2013; Olasantan, 2001; Salau et al., 2015). Common weeds of cassava fields worldwide are shown in Table 1.

Weed infestation is one of the major constraints in cassava growing areas (Hauser et al., 2015; Ravindran and Ravi, 2009) and weeding is one of the major labour consuming activities (Agahiu et al., 2012; Cleave, 1974; Hauser et al., 2015; Osundare, 2007) (Fig. 1). Weeds cause severe yield losses and make harvesting cumbersome in root and tuber crops, including cassava. Yield losses in cassava due to uncontrolled weeds during the critical period of weed growth may reach up to 50–100% (Akobundu, 1980; Ambe et al., 1992; Hahn and Keyser, 1985; Leihner, 2002; Moody and Ezumah, 1974; Silva et al., 2013). Yield loss of cassava due to uncontrolled weed growth in Africa, the major cassava growing region in the world is estimated to be at least 50% (Akobundu, 1980; Iyagba, 2010; Korieocha, 2014). Depending on the type of weeds and weed density, such yield losses in cassava may vary between 40 and 100%, (Fadayomi, 1991; Iyagba, 2010). Weeds also affect the quality of cassava roots by directly overrunning underground storage organs or feeding on the resources available for roots and tubers (Nedunchezhiyan et al., 2013; Silva et al., 2013). Thus, control of weeds is critical, particularly in the first 3–4 months of cassava growth (Howeler, 2000; Labrada et al., 1994; Leihner, 1983; Mutsaers et al., 1993; Nedunchezhiyan et al., 2013). Hence, resource-poor farmers in the tropics spend more time and energy on weed control than on any other aspect of tropical root and tuber crop production (Iyagba, 2010; Korieocha, 2014; Moody and Ezumah, 1974).

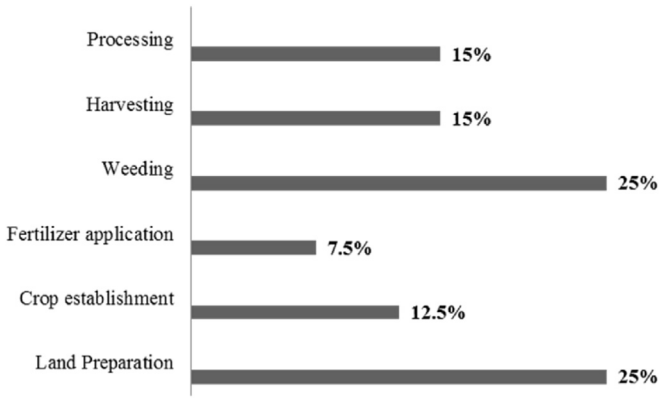

Fig. 1. Percentage labour input per hectare in each step of the production process of cassava, Source: Field summary data of Ekiti State, Nigeria, 2011 (Toluwase and Abduraheem, 2013).

Table 1
Common weeds of cassava.

Weed species	Family	Life cycle	References
Imperata cylindrica (L.) Beauv	Poaceae	Perennial	Doll et al. (1977) Melifonwu et al. (2000)
Cynodon dactylon (L.) Pers.	Poaceae	Perennial	Melifonwu et al. (2000)
Sorghum halepense (L.) Pers.	Poaceae	Perennial	Piedrahita and Doll (1974)
Melinis minutiflora P.Beauv.	Poaceae	Perennial	Doll et al. (1977)
Digitaria horizontalis Willd	Poaceae	Annual/Perennial	Melifonwu (1994)
Rottboellia cochinchinensis (Lour.) Clayton	Poaceae	Annual	Piedrahita and Doll (1974)
Panicum maximum Jacq.	Poaceae	Perennial	Melifonwu (1994) Melifonwu et al. (2000)
Pennisetum polystachion (L.) Schult.	Cyperaceae	Annual/Perennial	Melifonwu et al. (2000)
Cyperus rotundus L.	Cyperaceae	Perennial	Doll et al. (1977) Melifonwu et al. (2000) Olorunmaiye et al., 2013 Piedrahita and Doll (1974)
Mariscus alternifolius Vahl	Sedge	Perennial	Melifonwu et al. (2000)
Chromolaena odorata (L.) King and H.E. Robins.	Asteraceae	Perennial	Melifonwu et al. (2000)
Mimosa invisa Mart. ex Colla	Fabaceae	Perennial	Melifonwu (1994) Melifonwu et al. (2000)
Commelina benghalensis	Commelinaceae	Perennial	Doll et al. (1977) Melifonwu et al. (2000)
Euphorbia heterophylla L.	Euphorbiaceae	Annual	Melifonwu et al. (2000) Onochie (1975)
Tridax procumbens L.	Asteraceae	Annual	Melifonwu et al. (2000) Onochie (1975)
Ageratum conyzoides L.	Asteraceae	Annual	Doll et al. (1977) Melifonwu (1994) Melifonwu et al. (2000) Onochie (1975)
Talinum triangulare (L.) Juss.	Talinaceae	Annual	Melifonwu et al. (2000) Onochie (1975) Sharma and Dairo (1981)
Pteridium aquilinum (L.) Kuhn	Dennstaedtiaceae	Perennial	Doll et al. (1977)
Heteropogon contortus (L.) P.Beauv. ex Roem. and Schult	Poaceae	Perennial	Chikoye et al. (2001)
Sida acuta Burm.f.	Malvaceae	Annual/Perennial	Doll et al. (1977) Onochie (1975)
Portulaca oleracea L.	Portulacaceae	Annual	Doll et al. (1977) Onochie (1975)
Ipomoea spp. L.	Convolvulaceae	Annual	Onochie (1975) Piedrahita and Doll (1974)
Euphorbia hirta L.	Euphorbiaceae	Annual	Onochie (1975) Sharma and Dairo (1981)

Please cite this article in press as: Weerarathne, L.V.Y., et al., Does intercropping play a role in alleviating weeds in cassava as a non-chemical tool of weed management? – A review, Crop Protection (2016), http://dx.doi.org/10.1016/j.cropro.2016.08.028