Low-Cost Staking for Climbing Beans

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Summary

Adopting climbing bean offers a potential for increasing bean production in Africa, however, a major challenge to growing climbing beans is the requirement for plant support. Many farmers find this added expense difficult to meet and inadequate staking results in yield loss of 50% to 90%. This challenge is the most limiting factor for optimized yields and advancing wider adoption of climbing beans. Optimal staking of 50,000 stakes per hectare is challenged by a paucity of available wooden stakes. Overharvesting of stakes is also associated with deforestation and delayed afforestation, placing it at odds with environmental gains. Adequate staking requires an understanding of optimal plant density, appropriate length, and durability. A suite of farmer-acceptable, lower-cost and environmentally-friendly staking innovations is available. In particular, tripod arrangement or a strategic combination of stakes and string trellises results in the reduction of the wooden stakes needed.

Technical Description

Several low-cost staking methods present a range of options. Selection is largely dependent on availability and durability of different materials, labor requirements and costs. These technologies promote innovations that reduce the number of stakes per unit area and make the best use of readily available materials. Generally, the highest yields are obtained with stakes that are at least 2 meters tall and a staking density of at least 20,000 stakes per hectare. Up to that point, the taller and more sturdy the stakes are, the higher the yield! There are also returns to increasing the number of stakes to 50,000 per hectare. Stakes may be obtained from agroforestry species and tall grasses such as elephant grass (Pennisetum atropurpeum). Fast-growing agroforestry species suitable as stakes include Acacia angustissima, Alnus acuminata, bamboo, Calliandra calothyrsus, Gliricidia sepium, Sesbania sesban and Vernonia amygdalina. Such low cost staking arrangements include 1) single staking with less expensive materials, 2) wood and string trellis combinations, 3) tripod staking, and lastly 4) live plant support. When the beans reach the top of the trellis, the growing point of the main shoots should be pruned. This reduces height for easy harvesting and increases the growth of lateral shoots.

Uses

Low-cost staking of climbing beans assumes adequate supply of agro-forestry tree species or larger shrubs. Tripod staking has been adopted in regions with shallow soils and where the available staking materials are not very strong such as those from Pennisetum and involves tying 2, 3 or 4 long stakes together. If sticks are too short, the tip of the bean plant will flip over and fewer pods will form on those unsupported branches, while if stakes are too long (e.g. > 2.5 meters) the beans plants will produce excessive vegetative growth, and have fewer and less reachable pods.

Composition

Single staking relies upon stronger, longer woody stakes. These may be produced around farm boundaries or in small woodlots. Stakes may be recovered from larger trees as well such as Eucalyptus or Grevillea but care should be taken to not actively deforest areas, especially hillsides. Staking is often combined with string or wire trellises. From this horizontal stake or string, many ropes fall vertically over the climbing beans and act as support. Live staking uses intercrops stems such as maize and cassava to support the climbing bean in combination with additional woody stakes.

Means of application

Climbing beans can be planted in both row and hills. In rows, seeds should be spaced 15-25 cm apart allowing 50 cm between rows. Two seeds are placed in each station to give a plant population of approximately 200,000 plants ha-1. The sticks are sharpened prior to staking for ease in ground penetration. The stakes should have a rough surface to help the plant to grip and should be at least 2 meters in height. Staking is required about two weeks from seedling emergence. In single staking, a stake can support 1 to 4 plants with an inter-stake space of 0.4 m while each stake of the tripod can support 1 to 3 plants. Connecting stakes increases their strength. Wooden string trellises can accommodate two adjacent bean rows. Vertical strings may be replaced by nets with openings of 10 cm (e.g. “cucumber netting”) secured to the ground with stakes or wires. Lower cost vertical support may be obtained from reeds, strips of tree bark or even stems of a creeping plants and vines. In live staking, after maize harvest, the strongest stalks are left to serve as stakes for the climbing beans the following season. Alternatively, four maize stalks are tied together at the top to form a tent-like structure, forming the basis for a maize-climbing bean rotation.

Agroecologies	Highlands, Humid forest, Moist savanna.
Regions	Africa South of Sahara.
Developed in Countries	Ghana, Zambia, Uganda, Tanzania, South Sudan, Rwanda, Nigeria, Mozambique, Malawi, Kenya, Ivory Coast, Ethiopia, Democratic Republic of the Congo, Central African Republic, Cameroon, Burundi, Benin.

Available in	Ghana, Zambia, Uganda, Tanzania, South Sudan, Rwanda, Nigeria, Mozambique, Malawi, Kenya, Ivory Coast, Ethiopia, Democratic Republic of the Congo, Central African Republic, Cameroon, Burundi, Benin.
Solution Forms	Management.
Solution Applications	Soil/land conservation.
Agricultural Commodities	Common bean.
Target Beneficiaries	Small-scale farmers, Commercial farmers, Women, Youth.

Commercialization

Commercialization Category

Commercially available

Startup Requirements

Widespread adoption of the low-cost staking approaches can be achieved by: 1) Raising awareness about the benefits of proper staking on climbing bean yields, 2) Sensitizing farmers on the available low-cost technologies that can be used for staking, 3) Disseminating decision support tools and recommendations through farmer networks and extension agencies, and 4) Ensuring access to small loans that help offset initial investments for staking materials and labor.

Production Costs

Information on these low cost staking innovations is free and can be downloaded from the internet. Larger wooden poles are relatively more expensive and their harvesting may raise environmental concerns. The construction of trellises or use of live stems for staking significantly reduces the number of wooden stakes. Production and use of rapidly growing multipurpose agroforestry species enables farmers to produce their own stakes and when purchased, are less expensive.

Customer Segmentation

Low-cost staking is important to smallholders’ farming systems, especially poorer households. The technology has also enabled adoption of climbing bean cultivation by farmers in new and non-traditional bean growing areas.

Potential Profitability

Climbing beans have potential to provide farmers with yields three times greater than bush beans. The construction of trellises or use of live stems in combination with wooden stakes significantly reduces the number of wooden stakes needed and the minimum loss of grain yield benefits per unit area. In Rwanda, farmers preferred a staking density of 16,667 wooden stakes per hectare combined with string trellis that resulted in reduction of the staking rate by 67% with insignificant yield reduction. A promising trend is that in areas where climbing bean is widespread, the cost of stakes may decline as more farmers take interest in their production and sales.

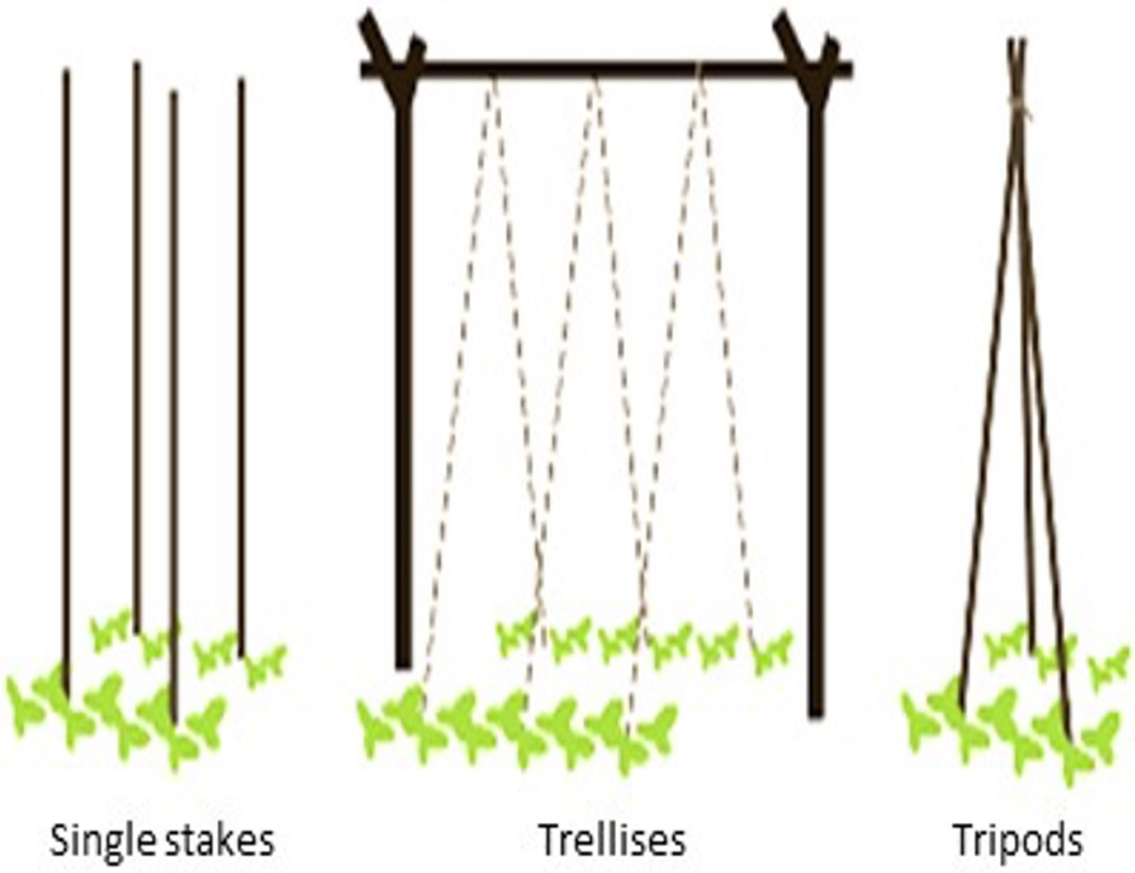
Licensing Requirements

Farmers do not require licenses for adopting the low cost staking innovations, while the cutting of trees for poles may be subject to environmental regulations and community by-laws.

Innovation as Public Good

Manuals for implementing low cost staking technologies in climbing beans and other crops requiring support are disseminated as a Regional Public Good by several research and development organizations including the TAAT High Iron Bean Compact.

Solution Images



Different types of stakes for climbing beans

Single stakes for climbing beans

Institutions

Alliance

Bioversity International

CIAT

International Center for Tropical Agriculture

Since 1967 Science to cultivate change

Accompanying Solutions

Climbing Bean with High Yield and N Fixation