New Manual Step-seeder for Subsistence Maize Farmers

Special applications to the Eastern Mid-hills of Nepal

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Introduction

In the Eastern Mid-hills of Nepal the agroecosystem is defined by narrow plots, steep hills, significant distance and altitude from the home, small total farm size, plot size variation, remoteness and poverty. Mechanised seeding methods increase net benefits to farmers. The “step seeder” was designed based on the local needs of farmers in this region. In the step seeder the weight of a human is used penetrate the soil, create a hole and plant a seed during walking. The first foot mounted maize seeder was patented in 1856. Other designs were patented in the early 20th Century but it appears that no significant problem based research development of step seeders has occurred until now.

Methodology

CAD software was used to create the design (Fig.1, 2). Prototype 1 was built with recycled materials (Fig. 3). The current prototype (P2, Fig. 4, 5, 6) was built using a combination of basic metalwork (Fig. 4, A, B, E), computerized numeric control cutting (CNC) (Fig. 4, 5, 6, D, G), and advanced machining (Fig. 4, 5, 6, I, C). All parts were made of mild steel with the exception of nylon (Fig. 4, 5, 6, I, C), rubber (Fig. 4, 6, H) , plastic coated cable and plastic tubing (Fig. 4, 6, F) and springs (high tensile steel, Fig. 4, 6, A, B). The machine is mounted to the user’s foot and leg (Fig. 1, 3, 4, D,G).

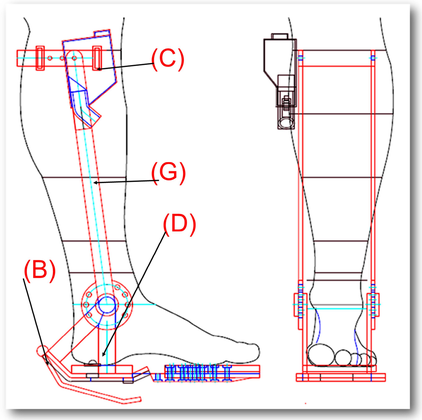

Fig. 1– CAD concept drawings.

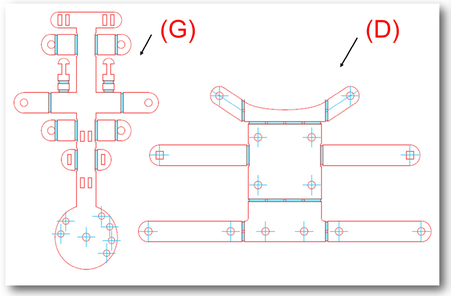

Fig. 2– CAD drawing for computerized cutting.

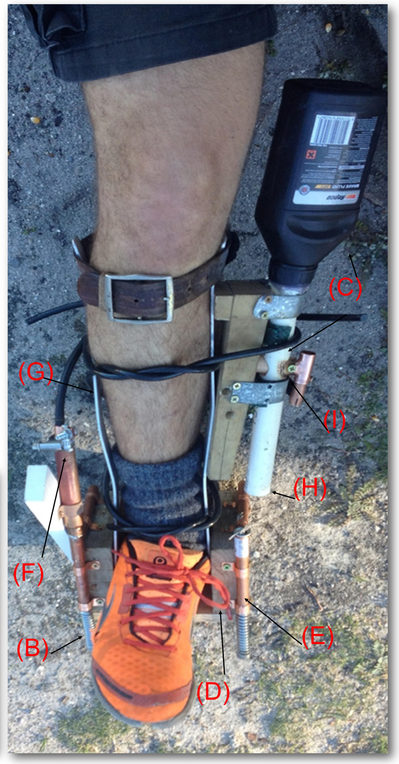

Fig. 3– Prototype 1. Made from recycled materials.

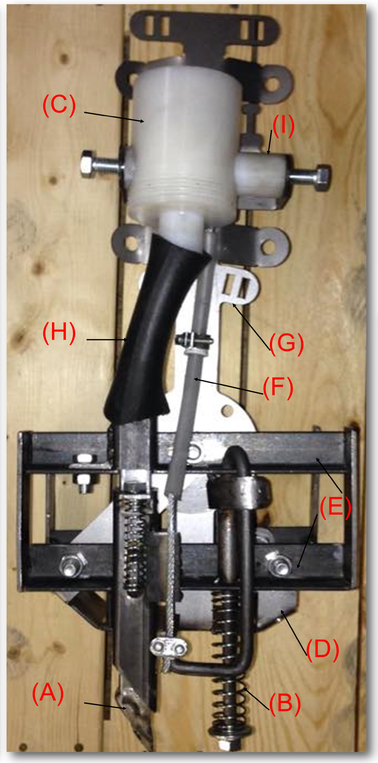

Fig. 4– Prototype 2 (P2). Made from common industrial materials.

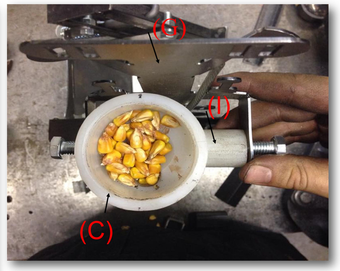

Fig. 5– P2 seed hopper (Part C).

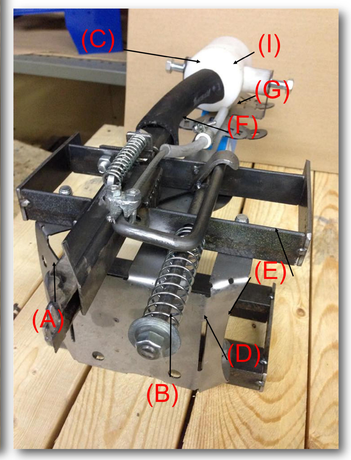

Fig. 6– P2 injection (Part A) and initiation (Part B) mechanisms.

Operation

Begins when the weight of the user compresses Part B transferring force through Part F, rotating Part I. Simultaneously Part A is driven into the ground, which causes the opening of Part A to close. Part I contains a recess allowing one seed to pass from Part C to Part H. The force of gravity allows the seed to fall into Part A. When the user lifts their foot, the mechanism covering the open end of Part A is released leaving the seed behind in the hole. Part B is also decompressed at this point returning the recess in Part I to a dorsal position in Part C to collect another seed for the next cycle.

Future Testing

The step seeder will be tested in the Eastern Mid-hills of Nepal during the 2016 planting season. Along with the step seeder, the efficacy of other seeding methods commonly used in the region will be tested for comparison. These seeding methods may include, dibbling, behind-the-plough, broadcast, jab stick, horizontal drilling and rotary injection seeding. The efficacy of these methods will be tested via germination rates. Additionally field and soil conditions will be recorded to control for plot variation. Farmers will be surveyed in focus groups and individually.

Future Design

As many parts as possible will be cut with CNC on thin flat material (similar to Fig. 2) for easy shipping and forming. It will be assembled by local vendors or possibly farmers, using colour coded instructions, to reduce manufacturing costs. Fastener types will be limited to two sizes. Additionally a phone help number will be printed on each seeder to enable repairs.

Acknowledgements

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