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Could Local Agricultural Machines Make a Country 'Impact Free' by 2010?

Emanuela Cepolina
Snail Aid – Technology for Development

Matteo Zoppi
PMARlab, University of Genoa

Could Local Agricultural Machines Make a Country 'Impact Free' by 2010?

by Emanuela Elisa Cepolina [Snail Aid–Technology for Development] and Matteo Zoppi [University of Genova]

Many countries affected by landmines are also facing food crises, underscoring the necessity of cost-effective mine removal. Converting agricultural machines already available in many mine-affected countries for use on mine-action projects saves not only time but also money by speeding up the removal process and turning the land back into an agricultural resource.

An important milestone for the mine-action community was reached in March 2009: the first deadline for the mine-affected countries that signed the Ottawa Convention in 1997 to complete clearance. Unfortunately, two-thirds of them did not meet their obligations. Fifteen countries, including Bosnia and Herzegovina, asked for deadline extensions of one to 10 years, leaving a large percentage of their territories unsafe, and forcing their weak economies to support expensive mine-action activities for longer periods of time.

The year 2009 also saw many people around the world starving due to a global food crisis that started two years before. Different sources estimated, for example, that almost one-third of Tajikistan's 6.7 million inhabitants would not have enough to eat last winter. [1, 2] Many more landmine-plagued countries, such as Burma (Myanmar), Egypt, Mozambique and Somalia, are also facing famine.

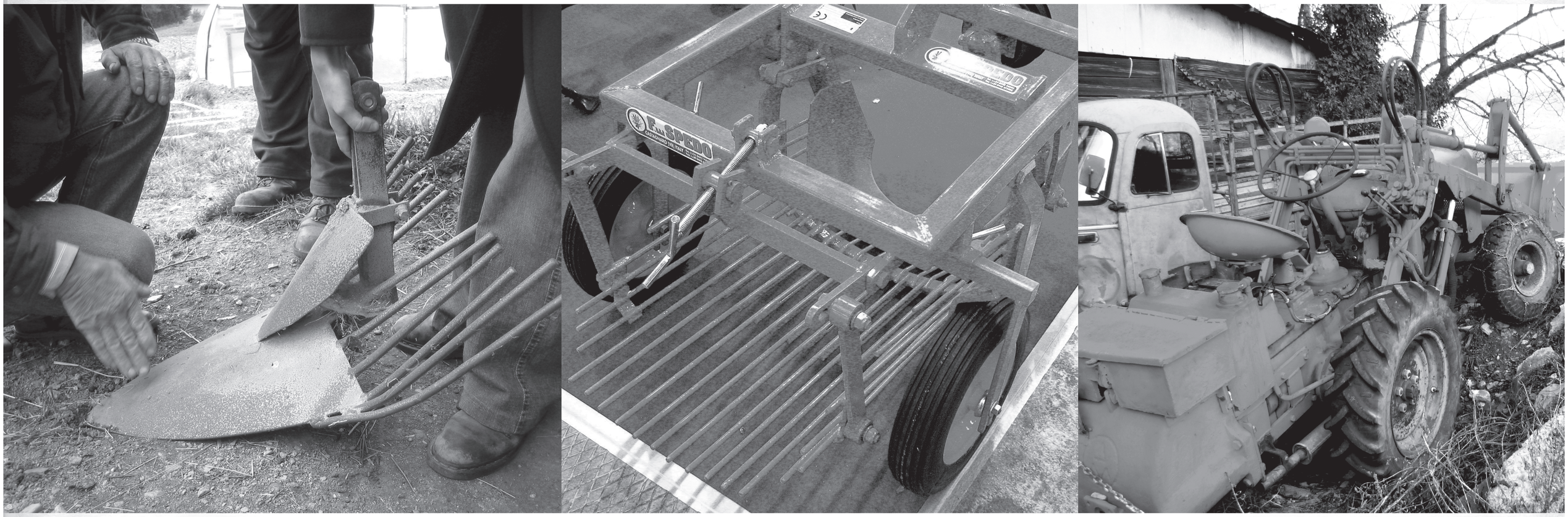
The need for quick land release of suspected or mine-affected land for agricultural and grazing use is growing. If a move toward cheaper and more efficient mine-action practices has always been desirable, it is now an imperative.

As often happens, during crises, solutions arise. In fact, we are currently witnessing a dramatic change in mine action: the acceptance and standardization of persistent residual risk after clearance[3] and opposition to the traditional requirement under the Ottawa Convention of removal and/or destruction of all mine and unexploded-ordnance hazards from the specified area to a specified depth.[4]

General and Technical Survey

In light of the need to fulfill Ottawa Convention obligations and the pressing need to return cleared land to local populations, the land-release concept aims to use current resources more efficiently by better managing information and defining the actual size of minefields so that expensive resources and equipment can be devoted to high-risk areas. Clearance is generally[5] limited to only 3 percent of the entire Suspected Hazardous Area processed. The remaining area that is released through General and Technical Survey is not physically cleared, or at least not completely, and therefore contains an element of risk that explosive hazards may remain. Full clearance activities will not guarantee that an area is completely free of mines, and land released after area reduction is generally considered to contain a higher residual risk.

Nevertheless, area reduction through General and Technical Survey is increasingly being used in many programs around the world, such as Cambodia and Mozambique. This important shift toward the acceptance of a residual risk after clearance allows for treatment of the problem in terms of risk management and the substitution, at least partially, of full clearance activities with a combination of cheaper and less thorough (and thus less reliable) methods to lower the risk to a tolerable level. A tolerable risk is defined as a risk that is accepted in a given context based on the values of the society being assisted, and a re-definition of the problem from a global to local scale.



Above and opposite page: Examples of agricultural machines that could be employed in Technical Survey operations with only minor adjustments.
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This redefinition might be the first step toward the achievement of a more efficient and sustainable solution for area reduction, leading to a higher respect for local traditions and biodiversities that is already occurring in many fields outside of mine action.

Demining Machines

According to the *Mechanical Demining Equipment Catalogue,*[6] produced by the Geneva International Centre for Humanitarian Demining in January 2008, there are fewer than 650 demining machines working in mine-action programs around the world. The market for humanitarian-demining mechanical technology is small and driven by donors rather than mine-action programs or operators. Machines included in the catalog are expensive, with specialized equipment designed to destroy mines with massive weight, heavily armored to be safe for the operator, or equipped with complex control systems for remote operation. Buyers of these technologies are often donors rather than program coordinators. Machines are marketed in the same way as military equipment, and prices are often part of packages that are negotiated in private. Therefore, cost and number of units are not comparable to those of other demining technologies directly bought by programs, such as sensor technologies.[7]

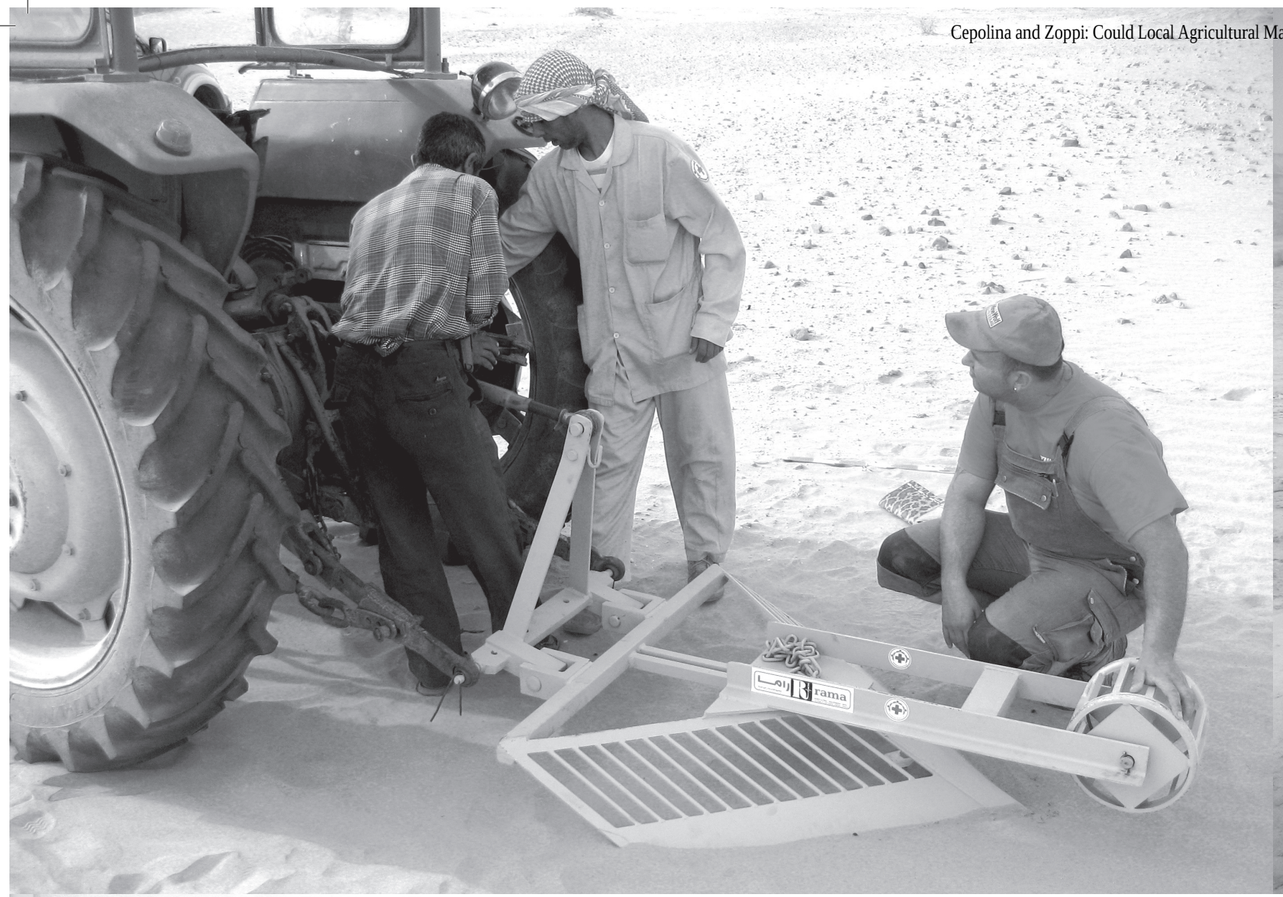
The performance test described by *Comité Européen de Normalisation* Workshop Agreement 15044 estimates that a single machine can withstand 450 landmine explosions in the same trial. Machines to be employed in Technical Survey mainly need to verify the absence of mines in the given area. If they encounter an explosion, the area needs to be re-categorized and fully processed by proper clearance. This means that machines used in Technical Survey must be able to process the ground and to resist—or not be severely damaged by—only one explosion at a time, while keeping the operator safe. Thus, the specifications to which dedicated demining machines are designed are unnecessarily strict for Technical Survey.

Stringent requirements for demining machines, including being able to withstand hundreds of explosions in one trial, are the main reason for high prices and limited use. As production is also limited, demining machines have to address the widest variety of scenarios possible, resulting in highly complex mechanics and poor local maintainability. They represent a solution to the problem that is more global than local; therefore, while a demining machine's cost and robustness can justify its use where full clearance is needed, other less expensive and more widely available machines need to be developed for gathering the information required to release land through Technical Survey.

Local Agricultural Technologies for Land Release

In this context, it is important not to introduce newer technologies dedicated to demining, but to use locally available ones whenever possible. Machines developed or re-adapted locally have lower initial costs, shorter downtime and lower repair costs. It stands to reason that machines produced outside a local area would also be underutilized due to the lack of spare parts or the expertise needed to fix them.

Local machines are also much more sustainable than imported technologies, which are often designed with little consideration for local condi-



Above and opposite page: Test of the ground-processing tool designed by Snail Aid and the University of Genova in Jordan. The tractor unit here is a tractor hired locally and driven backwards.

tions. Current, expensive technologies and labor-intensive manual-demining practices can be used to clear land that is not otherwise released. The largest possible quantity of new, simple, and less-robust technologies, available locally, can be used for what was formerly called *area reduction* and is now referred to as *land release by Technical Survey*. As long as no machine is expected to conduct clearance without manual or mine-detection dog follow-up, a wide range of machines can be used to prepare the land for release.[8] In fact, a quick solution to the landmine problem could already be available in mine-affected countries.

As their job is to process the ground, agricultural machines could be efficiently employed. Agricultural technologies are largely available and come in different sizes. Where they are not already available, their presence might be desirable not only in mine action, but also to increase food production, as agricultural machines used in demining can be reconverted for agricultural needs when they are no longer needed for clearance. As mine-affected countries are traditionally agriculturally based, some agricultural resources are already available. Nevertheless, investments in agricultural research and development are key to addressing other serious problems such as climate change and soil erosion. If we agree on the need to provide appropriate and sustainable solutions that consider the environmental, cultural, social and economical contexts in which they will function, then we should also consider the future of the countries in which these technologies will work.

By introducing facilities capable of adapting agricultural tools to demining activities, we can support research and development in agriculture. As suggested by the National Bank for Agriculture and Rural Development,[9] to achieve the desired average farm power availability of two kilowatts per hectare (about 2.5 acres),[10] agricultural service centers could be established. There, machinery could be provided as and when needed on a custom-hire basis to farmers on small- and medium-sized farms who cannot afford to purchase their own machinery. In the same manner, these agricultural service centers could also provide machines for Technical Survey. They could develop the modifications required to effectively address the demining problem locally, then acquire these machines and provide assistance.

Agricultural machines have long existed and can be repaired in every developing country in local workshops. The adaptability of agricultural technologies is another advantage; the same tools can be mounted on different tractor units and replaced by dedicated agricultural tools when demining operations are over. Involving local technicians in the redesign of new or improved technology also helps reduce dependency of local communities on donor assistance, as well as facilitates local human development—satisfying basic human needs and capabilities.[11] Empowerment is an integral part of many poverty-reduction programs. It is essential not only for the state to provide resources and opportunities, but also for citizens to take responsibility for self-improvement. It is desirable and necessary for local entities to assume mine-action activities so that a local capacity may be developed for the use of agricultural technologies in land-release activities.

Adapting Agricultural Technologies to Technical Survey

Agricultural machines need to be adapted to the demining task. Special tools for ground processing at the required depth might be attached to standard linkages, such as three-point linkages on tractor units. In many cases, the explosive threat a SHA poses will be known before operations start. Information collected from local sources can help define the specific threat an area might contain. Even if not designed to withstand anti-tank landmine explosions, machines must keep the operator safe. This aim can be achieved in two ways: by operating the machine remotely or by isolating the operator from the machine structure when driven manually. While a simple remote-control system can be realized in a modular way, relatively inexpensive[12] and semi-autonomous machines are considered a key element in improving total quality management in mine action.[13] To keep the operator near manual machines, either on board or driving it by handling

it from behind, it is necessary to install shock isolators between the handler or driving wheel and the machine structure. If supporting an on-board operator, the seat must also be isolated from shock waves caused by explosions.

Another key issue in adapting agricultural technology to Technical Survey is armoring. If the machine is equipped in a way that supports tools at the front, only a light shield may be needed to protect the delicate parts. Otherwise, if the machine is originally conceived to support tools at the back, as is frequently the case, then a system to protect the undercarriage from possible damage caused by the explosion of mines must be implemented. A good approach in this case is to design special blast-resistant wheels that do not transmit the shock associated with an explosion to the chassis either by deforming flexibly or by releasing energy through frictional pins. Research on blast-resistant wheels, shock isolators and modular remote-control systems, if flexible enough to be adapted to different agricultural machines, would benefit Technical Survey processes enormously.

The Case of BiH

According to the *Landmine Monitor Report 2008*, 170 square kilometers (42,000 acres) of land were released to public use through area reduction in Bosnia and Herzegovina in 2007, using 21 accredited demining machines.[14] The estimated area that still needs to be cleared consists of 1,738 square kilometers (430,000 acres). If we look at the number of agricultural tractors in the country, approximately 30,000 units,[15] and we imagine temporarily equipping 300 of them, i.e., 1 percent of all units available, with low-cost ground-processing tools and light armoring for assessing the presence of landmines, assuming that each one could have the same productivity of one of the 21 machines used for area reduction in 2007 (around eight square kilometers [three square miles] per year), the problem of landmines in BiH could be potentially solved or drastically reduced to small, confined, highly contaminated areas in less than one year.

Conclusion

As under-developed countries continue to be affected by the world food crisis, the need for arable land is increasing. Research into more responsible agricultural practices is also becoming an imperative to fight the dramatic consequences of climate change. Investing in the redesign of local agricultural technologies can both speed up mine clearance and improve the future for mine-affected countries by addressing these other challenges simultaneously. By approaching the issue on a local instead of global level, more appropriate, sustainable and reasonable solutions can be achieved while fostering the empowerment of local populations.

See Endnotes, page 62

Emanuela Elisa Cepolina recently completed her doctorate in mechanical engineering. She has been researching technologies for humanitarian demining since 2003—first at the University of Genova, and recently as president of the nascent nonprofit association Snail Aid–Technology for Development.

Emanuela Elisa Cepolina
Snail Aid–Technology for Development
Via Cabella 10/12, 16122
Genova / Italy
Tel: +39 010 4042 019
Mobile: +39 333 1655 089
E-mail: emacepo@dimec.unigeit,
ceppo79@hotmail.com
Web site: http://www.snailaid.org

Matteo Zoppi is a researcher in the Department Mechanics and Machine Design at the University of Genoa, PMARlab Robotics Group, with research lines on development, design, fabrication, and testing of mechatronics and robotics systems for industrial and service applications, application-oriented synthesis and design, and methods for analysis—in particular kinematics and singularity analysis, and design of Micro Electrical Mechanical Systems.

Matteo Zoppi
Researcher
Department of Mechanics
and Machine Design
University of Genova
Via All'Opera Pia 15A
16145 Genova / Italy
Tel: +39 010 3532 837
E-mail: zoppi@dimec.unige.it