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SUMMARY OF E-CONFERENCE ON 2-WHEEL TRACTORS FOR CONSERVATION-AGRICULTURE; CONDUCTED DURING SEPTEMBER 2005

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My original inquiry to Scott Justice, Nepal, developed into an informal e-conference. This was a great demonstration of what is possible with global communications to enhance knowledge distribution. My inquiry related to the potential introduction of 2-wheel tractors in conjunction with current adoption efforts in conservation agriculture (CA) in East and South Africa. The following is a summary and commentary on the unique contributions by 11 international experts on a current topic.

SUMMARY OF E-CONFERENCE:

The correspondents all focused on the smallholder village farmers of the world. There seemed to be a general agreement that agricultural crop production is vitally important to these farmers as individuals, to their local communities, to their regions, and to global food supplies, both current and future. Although the justification may vary from region to region, there seemed to be sound reasons to strive to redouble our efforts to develop and introduce improved methods of crop production. Reasons included the need to address rural poverty, food sustainability, the increasing costs of farm labor, decreasing availability of youthful farm labor, reduction in available farm labor due to AIDS-related disabilities, desire for reduction of the drudgery of farm operations, increasing need to transport loads to and from the farm, decreasing production in some regions, degrading and poor soil health, and others.

Some correspondents felt that 2-wheel tractors had not been successfully introduced into African agriculture in the past and that new efforts for introduction at this time would also meet with failure. Others with experience in Asia offered that the same appraisals were made there 10 years ago with expensive Japanese brand tractors, only to now see tens of thousands of inexpensive Chinese brand two-tractors being imported annually for agricultural use. Correspondents suggested that certain situations would be needed to support the use of 2-wheel tractors including, situations where there is multiple-use for irrigation pumping, duty-free or reduced tariff import pricing, high value crops, multiple crops per year, labor shortages, higher population densities, off-farm income opportunities, and increase projects to use for cargo transportation. Please notice that these are all economic-reasons; not technical reasons.

Several contributors suggested that from their experiences, it was the aggressive activities of importers bolstered by governments reducing or eliminating tariff barriers, that made introduction possible in several Asian countries; that the importers in association with action-agency people/organizations had set up systems to provide tractors, spare parts, the means for repairs, and financing. Alternatively, it seems that importers have maintained inflated prices for tractors in some regions, which has restrained the rate of import/adoption in those regions.

Some reasons/problems/situations given for predicted lack of successful adoption in Africa were:

- The highly dusty field conditions (but, CA fields would not be dusty because the soil is covered with protective crop residues);
- The dispersed rural populations and long distances between population centers (distances which are too long for transport by 2-wheel tractor transporters);
- Inadequate crop production in dryland/rain-fed regions to economically support tractorization;
- Lack of irrigation-pumping supplementary use of the tractor engines to add economic value;
- Need to subsidize tractor ownership with money from wages and trade;
- Lack of importers;
- Lack of sources of spare parts;
- Lack of trained repair technicians and facilities;
- Lack of fuel supplies are needed;
- Earlier international projects promoting the expensive Japanese tractors individual farmers and not for “service providers”

It was stressed that it is not just the technology selection, but how it is promoted/extended, that greatly affects the final outcome. Correspondents suggested the use of PTD methodologies, working with all stakeholders/farmers and especially with private sector manufacturers and importers could have altered the outcomes.

I suspect that farmers around the world are similar. It was my personal observation that small farmers in the USA secured off-farm wage earning employment and immediately purchased tractors so that they could continue to conduct their farming operations while maintaining off-farm employment. In this same thought of similarities, USA farmers first used walking implements behind draft animals, but later “modernized” to implements with sulky seats for riding whenever possible. Some correspondents said that this has also been true in Asia, where 2-wheel tractors with riding-implements have become popular over the walk-behind tractors of Japan and S. Korea. I have been told that in at least some regions, that a farmer who does not walk with draft animals is considered to be lazy and is ostracized by his neighbors; but, will this social stigma carry over to tractorization? The use of tractors for transportation with cargo trailers and the farm-to-farm movement of tractors with implements to do contract-operations (tilling, seeding, spraying, etc.) would support the use of seated operators with tractors.

At least two contributors mentioned the traction limitations of 2-wheel tractors for tillage operations such as plowing and planting. One suggestion was that the two-wheel tractor powered rotovator attachment (60 and 80 cm wide), which is the primary tillage instrument in Asia, is basically self-propelled and traction - wheel slippage is not a factor. Another "rotovator type" attachment, that is gaining interest and some adoption in Asia is a powered 6-row, strip-till seed drill designed for the seeding of drilled crops, such as grain legumes, wheat and rice in closely spaced rows (20 cm). Again wheel traction with this CA machine is not a factor.

The current interest in Africa is for row-crop production (widely-spaced rows) such as maize and beans, so that there is much less soil penetration/disturbance/tillage required per unit of land area than with drilled crops. For these row crops and the above mentioned strip till seed drill, one must modify the seeder and add bold grain seed meters and reduce the number of rows. Reducing the number rows actually increases the forward speed and reduces the amount of time to plant a given area.

Alternatively, the current R&D emphasis on for CA implements in Africa appears to be the non-rotary single-row or widely-space 2-row implements. The number of seeder or fertilizer applicator row openers for CA implements will be limited by type of soil openers, soil hardness, and available tractor traction. Admittedly, there is a traction limitation to the number of rows that a two-wheel tractor can pull. In Asia the research has shown that up to four rows can be planted in sandy soil (inverted T - type openers) with the 2-wheel tractors. In heavier drier soils 1-2 rows is possible. After CA is an established practice, the common experience is that the surface soil becomes more friable (because of increased organic matter in the surface layer which improves soil structure, and because the residues on the soil surface retain more water in the soil so that the higher soil water content will reduce soil hardness) and this will reduce traction requirements for CA implement-draft.

One item that was not directly mentioned in the correspondence was the gender-issue. It seems that in many regions, it is the farm women who are doing the bulk of the farming operations. When draft animals are introduced, it seems to be the men who handle the draft animals. When tractors are introduced, it also seems to be a male-dominated operation. Some correspondents indicated that typical adoption patterns include contract field operations within villages by tractor owners (male!) for other farmers (female!) who have none. Such a system may then relieve the women-farmers from many high-drudgery operations, but still leave weed hoeing, harvesting, etc. as manual "female" operations. There are gender issues with the reduction of the farm labor force due to AIDS-related disabilities, disappearance of youth from rural areas, in-family and community social traditions, and other factors. Tractorization of rural agricultural communities may interact with gender issues to change the social structure of these families and communities.

I had touted the potential manufacture of 2-wheel tractors and implements for CA in Africa. Correspondents threw caution on this proposal, saying that from the experience in Asia, that importation of tractors from established, quality sources is the

best route to adoption. They said that the local manufacture of spare parts has been successful, as has been the establishment of local repair facilities. It seems that when annual tractor importation numbers reach into the tens of thousands, it is still economically reasonable to import rather than to sponsor in-country manufacturing. It was suggested that in-country or in-region manufacture of proven implements may be an appropriate/successful approach.

We did not receive information on the amount of cultivated land area that is necessary to economically support the ownership of 2-wheel tractorization, under conventional tillage and under CA. Similarly, we did not receive information on the amount of land area needed for the owner of a tractor system for contract-operations to be economically successful. One correspondent indicated that the relatively low rural population density in Africa would detract from the economic success of tractorization adoption. Relative to that idea, we did not receive any information on the density of tractor ownership that would be necessary to support successful spare parts, repair, and fuel-supply businesses. On this point, from the USA experience, every small rural town had these types of businesses, which have only now become extinct as large farms have required large machines and widely-located parts and service centers have replaced the local businesses.

My original inquiry included the introduction of CA implements along with 2-wheel tractors. The correspondents confirmed that there are no such items commercially available, globally, as CA implements for 2-wheel tractors! So, what I was proposing was only an idea and not a current reality. More than one person suggested that to simultaneously introduce two new technologies into a region would be more than difficult. I suggested that where animal-draft is just now being introduced into rural societies where it has not existed and where there is no animal-care technology, that it might be preferable to skip-over that hurdle and introduce 2-wheel tractorization. In some cases animal-draft and CA are being simultaneously introduced, so in those regions, they are already facing the real or perceived difficulties of dual-introduction.

Now, back to the reality of the almost-total lack of CA implements for 2-wheel tractors (there are powered strip-till rotovators in Asia that are CA implements): If we follow the example of early tractorization in other countries, animal-draft implements can be easily attached to 2-wheel tractors. That is only a good solution if the commercially available animal-draft CA implements are truly adequate machines (especially for low-rainfall regions such as many parts of Africa). One correspondent indicated that animal-draft CA implements now being imported from Brazil are “good” machines. Another correspondent indicated that they are also promoting the importation of these machines. A correspondent stated that short time-frame implement development schemes have led to non-results. In response to that comment, it is reasonable to utilize proven technologies from other countries, with appropriate modifications to adapt them to smallholder farm usage.

Perhaps, as a starting-point, the appropriate agencies can demonstrate the use of commercially-available imported machines, temporarily adapted to 2-wheel tractor draft.

This activity could be done in a farmer-participatory mode (as highly supported by several correspondents) in conjunction with ongoing CA adoption village-trails. Results would form the specifications for what is needed for future CA implements. One correspondent suggested that such alternative technologies should be demonstrated/introduced to the village farmers, as the poor farmers must be respected by letting them choose what they want or what is in their own interests. Another correspondent stated that it was the poor who would be empowered as service providers of such equipment, renting their services out to the other farmers.

If the initial village trials were promising, then introduction projects could be established. One correspondent cautioned that a long-term, steady-funding program is needed for success of this kind of a venture. It would require the establishment of the capacity to repair, manufacture, and use CA implements, as well as the importation and servicing of 2-wheel tractors. These would be private-sector support businesses, because several correspondents indicated that past governmental-agency efforts to provide tractorization have been failures.

One item which was not directly addressed was the specifications for 2-wheel tractors for CA implements. We were warned that some of the lowest-priced tractors have quality and design problems, so that experienced persons should be consulted during the selection of tractors to import/introduce. Because CA involves only low-draft minimal soil disturbance for seeding and fertilizer applications, and many operations such as herbicide spraying are very low-draft operations, it is possible that smaller tractors would be adequate. Such smaller tractors might require smaller transport trailers than currently used in Asia with larger 12-16 Hp tractors, but perhaps they would be more affordable by dryland village farmers. One contributor had seen a new offering of lighter weight (more modern design) diesel engines in China which will increase the selection of 2-wheel tractors for import into other countries. One contributor described small walking tractors as “toy tractors”, and it may be true that smaller may not be better.

When in Kenya in 2004, village farmers participating in CA adoption projects were found to be achieving dryland/rainfed maize yields of 30 bags, as compared to 10 bags from their traditional practices. If such increased production is sustainable, then there may be sufficient economic affordability to successfully adopt 2-wheel tractors into their CA (as soon as we can provide them with sources of suitable CA implements). When I asked these farmers if they would like to have tractors to use within five years, they answered, “yes”.

CONCLUSIONS:

It may be risky to attempt to structure concise conclusion statements from the above Summary. The conclusions may be different for each of us. For me, at this time, I conclude the following:

1. 2-wheel tractors can technically provide limited draft-power and transportation for smallholder farmers, either with conventional tillage or with CA;

2. CA implements are needed for 2-wheel tractors;
 - 2a. The Asian rotovator strip-till machine may be a good CA implement for Africa, if modified for row crops;
 - 2b. It may be possible to link Brazilian-exported CA implements with 2-wheel tractors;
 - 2c. There are opportunities for new alternative CA implements for 2-wheel tractors;
3. On-farm participatory demonstration-trials need to be conducted in Africa;
4. Technical feasibility must be established/demonstrated before long-term programs can be generated and before applicable economic analyses can be made;
5. Long-term attention and support will be needed for such technology introductions;

PARTICIPATING CORRESPONDENTS (In no particular order):

[Correspondents with contributions in the above Summary]

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