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# Rethinking a Basic Assumption in Ag Development: Risk Aversion vs Hunger and Exhaustion

*by Dick Tinsley with Dawn Berkelaar*

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*In this article, Dick shares that, generally speaking, farmers plant crops later than recommended, and that the general assumption for why they do this is to avoid risk. However, he argues that another and perhaps more plausible explanation is that they simply do not have enough energy to do the work required to prepare a field for planting on time. Before implementing a rural development project, Tinsley encourages change agents to take the time to determine if the beneficiaries can afford or otherwise have access to sufficient calories and other essential dietary needs to complete the daily tasks expected of them.*

## Introduction – A Questionable Assumption

In my opinion, there has been a fundamental oversight in the basic approach to agriculture development over the past 40 years. In the mid-1970s, on-farm researchers casually observed that smallholder producers delayed their crop establishment for up to eight weeks, with an average crop establishment of one month after the initial rains or other seasonal starting event. This was confirmed by averaging some of the initial farm record results.

The observation led to an assumption that smallholder farmers were risk averse and waiting for more assured rainfall, and that they inefficiently used the natural resources available to them. These were and remain mostly assumptions, suppositions, or hypotheses that have become deeply entrenched in development literature without any real proof or verification. Economic development for smallholder communities, while emphasizing technology development through small plot trials and an effective extension demonstration education program (to inform producers on the potential of new techniques), often fails to take into account the hours that farmers are physically able to devote to field work. The importance of early planting is emphasized, but without awareness of the operational resources that will be needed and of the availability of those resources to extend a technique from a small plot to a full farm within acceptable time limits.

***Figure 1.*** *Photo from the Philippines showing an 8-week spread in cropping. In the middle, buffalo are being used to prepare the land. Seedbeds are at the top right, while already transplanted fields are visible at the top of the photo. Photo by Dick Tinsley.*

## The Reality of Time Constraints

The basic problem was underestimating just how long a family takes to establish 1.5 ha of land. If the estimate is only two or three weeks, then the initial assumption would be correct and it should be possible to improve economic well-being by promoting earlier crop establishment, etc.

However, if a more accurate estimate is up to eight weeks—with the farmers working as hard as possible from the first opportunity—then the extended crop establishment period will render the farmers too late for most follow-up management practices such as hand weeding or effective use of recommended fertilizer rates. After eight weeks, the weed infestation and loss in potential yields will be substantial. The problem stems from limited resources to manage the land in a timely manner. In this case, it would be difficult to enhance the economic well-being of the smallholder without first enhancing the operational resources available for smallholders to manage their lands. In academic and development circles, it seems fairly easy to determine the labor and other resources

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required to complete a task (e.g. 300 person-hours of labor to manually prepare land; 60 person days to transplant 1 ha of rice). However, it seems considerably more difficult to determine if that labor is available within a smallholder community. Labor can be provided by family, casual workers and even migratory workers. It is also a mobile resource that moves through a smallholder community and may be better evaluated on a community basis than on an individual farm basis. In the development community or within a development project, who is responsible for determining if farmers have access to the resources needed to implement the development recommendations that are promoted for the smallholders' benefit across their farms?

In some cases, other family members assist with farm labor. However, steps should be taken to ensure that children are able to attend school, which is unlikely to happen if they are working full time in the field. And if a man's wife has substantial essential domestic tasks to do, such as fetching water and/or firewood, cooking, and nurturing children—that take priority over assisting with field work—it is unlikely that she will be able to provide much assistance with the field work.

## The Caloric Energy Balance

Another factor may contribute to prolonged crop establishment that continues well beyond the projected time: the limited diet available to smallholders during critical times of high manual labor needs, such as basic crop establishment at the beginning of the growing season. Undernutrition and malnutrition are recognized as major concerns in smallholder communities; consider the oft-mentioned boilerplate that smallholders produce only sufficient food for six months. Many efforts to alleviate poverty focus on reducing nutritional deficiencies, in terms of protein, vitamins, minerals, etc. Yet **rarely is hunger recognized as a potential major impediment to the development efforts**.

Many smallholder farmers experience undernutrition in the form of a major deficit in the "caloric energy balance," which compares the number of calories a person is expected to exert in implementing a development program, and the number of calories the person has access to. Smallholder farmers may have access to only 2000 kilocalories when they need in excess of 4000 kilocalories to complete a full day of diligent field work. As a result, farmers may have only enough caloric energy to work three or four hours a day, which will substantially increase the time or days required to complete different agronomic tasks, and which will seriously limit the farmers' ability to take advantage of innovations that are promoted for their benefit—particularly labor-intensive innovations.

If smallholders produce only enough to feed their families for six months, they will be running out of food just as the next growing season begins. It may be impossible for them to consume sufficient calories to undertake a full day of crop management field work. If it takes 2000 kilocalories just for basic metabolism to meet daily subsistence needs, and an additional 220 kcal per hour for sustainable field work, a person would need to consume at least 4000 kcal to work a full 10 hour day. (This excludes the heavy digging associated with initial manual land preparation, which could increase the energy requirements even more.) If farmers are not able to consume this amount, they will be unable to complete the day's work and be forced to come home early in the afternoon to recover from exhaustion. This could give the appearance of "idleness."


***Figure 2.*** *Amount of various staple foods that each correspond to 4000 kcal of energy. Photo courtesy of Whole Foods, Fort Collins, Colorado.*

A typical diet would be 500 g/day of uncooked rice, which is the average per capita consumption in Myanmar and represents the highest average daily rice consumption in the world. This would provide only about 2000 kilocalories. Even at the low consumer prices found in most developing countries, a person living near or below the World Bank's oft-quoted US$2/day poverty index would have to spend the majority of his or her income just to meet the 4000 kilocalories required for a full day of field work. To meet this energy requirement would require either 1.1 kg of maize, or 1.1 kg rice, or 1.1 kg wheat flour, or 2.5 kg cassava, or 4.6 kg sweet potatoes, or 3.3 kg of plantains (these weights refer to uncooked amounts). This diet would supply enough energy, but would not provide the protein, essential minerals and vitamins that are necessary for a person to be healthy enough to endure a full day of agricultural field work. These other nutrients have to come from meat, fish, beans, vegetables and fruits that are normally more expensive than starchy foods—so purchasing and consuming them would most likely result in a reduction in overall calories. This in turn would reduce the amount of work that could be expected from that individual. Thus, before any effort is made to mobilize "idleness," it would be appropriate to determine if the individuals have ready access to the upward of 4000 kilocalories that would separate idleness from hunger and exhaustion.

Figure 2 shows the volume of food listed above for various staple energy sources. For an individual to purchase a 4000 kilocalorie portion in various developing countries it will cost anywhere from US$0.30 to US$1.99 depending on the country and staple food involved (see http://lamar.colostate.edu/~rtinsley/Table1-Price4000Kcals.pdf).

In a classroom exercise using consumer price comparison lists, when all foods were considered for a more complete balanced diet, the total of available calories was reduced to approximately 3000 kilocalories. (3000 kcal/day is slightly higher than the case studies in a recent ODI Paper "On Improving Nutrition for Smallholders." In that paper, the five case studies list kcal/day ranging from < 2000 to nearly 3000 kcal/day.) Subtracting the 2000 kilocalories needed just to sustain the body's biological activities, the kilocalories available for field work could be 1000 or less—leaving less than four hours' energy for field work. Isn't this consistent with what is often observed when visiting smallholder communities? Often visitors arrive in the late morning, when many farmers will have already completed the four hours of field work that their diet permits. These farmers will be heading home, exhausted, having started their work early in the morning. Some essential domestic chores will still need to be done, such as obtaining water for the household, perhaps getting fire wood, cooking meals, nurturing children, etc. These activities would be an additional drain on the calories that are available for field work.

To see a detailed analysis of a potential Caloric Energy Balance in Ethiopia (done by a workshop participant), see this link: http://lamar.colostate.edu/~rtinsley/EthiopiaDiet.html. The result of the analysis was

similar to the conclusion of this article: based on wages, food prices and number of family members needing to eat, a farmer is unlikely to have enough energy to do more than 4.6 hours of field work per day. This is consistent with the casual labor work day in neighboring Kenya, which is set at 5 hours/day. With a 5-hour work day, it would seem possible for someone to work a double shift, but this does not happen and is not encouraged by hiring farmers. One farmer that was interviewed indicated that if a person worked a double shift, they would be unable to work the following day.

## Subsistence Supplies

While consumer prices are the most readily available data to collect for this analysis, and US$2.00 per person per day is the accepted standard definition of poverty according to the World Bank, smallholder producers usually produce most of the food they consume, particularly the staple foods that are the primary source of calories such as those shown in Figure 2. However, the amount of subsistence food that is available is more difficult to determine, and would be more variable within a specific host country and between individual farmers. I do have an estimate from farmers in Malawi, who indicated that they reserved about four 50-kg bags of maize per person for personal consumption. This would amount to roughly 200 kg/yr or 547 g/day, which would provide 2030 kcal/day as the primary source of dietary energy. Four bags of 50 kg each per person is very consistent with the Millennium Villages Project, which allocates 1.1 tons of maize per family of 5.7 people. This amounts to 193 kg/person/year or 529 g/day, which provides 1930 kcal/person/day. At this rate, the stored food would be sufficient to sustain a person, but would not allow him/her to undertake substantial field work.

## Labor-saving Interventions

Instead of proposing labor-intensive interventions, enhancing the operational resources available to smallholder farmers can result in a substantial increase in economic well-being. A good example is the retirement of the water buffalo in favor of the power tiller for rice cultivation in Thailand and other parts of Asia, a shift that took place concurrent with the "green revolution" and helped it to succeed. Use of power tillers reduced the crop establishment period by half and allowed small scale farmers to expand their holdings, diversify their farm enterprises and enjoy some comfort items such as refrigerators, motorcycles, TVs and VCRs. With rice production under control, Thai farmers were able to undertake many of the value-chain cash enterprises envisioned in development projects, such as contract vegetables for the Japanese market, or poultry and pig production suspended over fish ponds. The conversion from water buffalo to power tillers was self-financed and took place completely under the radar screen of the development community. It remains little recognized by the development community trying to extend the "green revolution" from Asia to Africa. The latter emphasizes research into improved technology and enhanced access to inputs, but fails to extend this to enhancing operational resources to expedite crop establishment and land management.

***Figure 3.*** *Sri Lanka couple manually preparing their rice paddy. How many calories are they exerting? How long will it take to complete one hectare?*

Enhancing resources that are available for land management often involves access to mechanization. Most likely when using four-wheel tractors, this will not be in terms of direct ownership by farmers, but rather contract availability via small family-owned village-based support service providers that have a symbiotic association with the smallholder producers. There appears to be considerable demand for these services, even in remote parts of Africa where manual field operations continue to dominate. In Zambia, farmers have expressed an interest in such services and can even quote the price for it. The prevailing price in 2005 was ZK 100,000 (US$20) per hour. During this hour an operator could custom till between 0.25 and 0.50 ha. Similar quotes can be obtained in Uganda, Malawi, Nigeria, Ghana and Kenya. In Egypt, Pakistan, Iraq and Afghanistan, most land preparation is done by individually owned 65 hp tractors such as the Massy Ferguson 165 (and has been for several decades). The importance of such contract tillage appears to take place under the radar screen of the development community, which remains fixed on the idea that maintenance of machinery is beyond the capacity of smallholder communities with limited education. Perhaps they are thinking of the difficulties with public sector mechanization units, and unable to distinguish public sector from private sector. Perhaps the development community can rethink this, and instead facilitate a community-based approach based on symbiotic relationships within villages between producers and local family-based support service providers. This might require some adjustments to the institutional credit system, for example, to assist with the purchase of tractors and initial operating costs.

Village grain mills are another good option to consider, if they are not already available. They might reduce women's domestic drudgery, and increase their ability to remain in the field longer each day or to arrive more refreshed and better able to manage the farm enterprises.

Improving access to domestic water would have a marked health impact; the time saving would also allow women to pursue other economic opportunities for the benefit of their families, including assisting their husbands with field work.

## More Implications for Development

If the argument in this article is correct, and has been since the beginning of the rural development effort some 40 years ago, then instead of delaying cultivation, farmers were most likely starting their crop establishment at the first opportunity when the monthly rainfall variable approached 100%, and continuing as fast as their available energy would allow. **Rather than being risk averse, smallholder farmers are and have always been mandatory risk takers, with their very survival dependent upon taking these risks.** If their available diet limits the hours they can work each day, and thus extends the crop establishment period well into the time when potential yields may be rapidly declining (particularly for maize in Africa), then any delay will reduce potential yields and put their very survival at risk. Given the critical need for subsistence production and the amount of field work that is clearly needed, what is the more realistic scenario for anyone seen idling away the

afternoon in the village? Are they being risk averse, or hungry and exhausted?

Limited dietary energy's drag on farm management does not even account for the two or three times a year farmers suffer a bout of malaria and cannot work for a couple days, the times they get dysentery and lose another day, and the increasing impact of the HIV/AIDS epidemic that casts a dark shadow over rural Africa and the available labor.

As crop establishment is delayed and has to be integrated with weeding and other mid-season crop husbandry activities on early established parcels of land, farmers will compromise on quality management in favor of cultivating a more extensive area. This is a very rational economic decision, but can give the impression that farmers have limited knowledge of best management practices and need to be taught the best management practices. In actuality, they may be well versed in such practices but not have sufficient labor to fully adopt them.

A few other items to note: first, the typical smallholder farm size of 1.5 ha, that appears common in many developing countries, may represent the outer limit of what a farmer can manually manage, rather than the availability of land within the community. Second, the midday siesta, common in some countries as an opportunity to escape the heat of the day, might equally be due to exhaustion from exerting all the available calories and a need to recover from the exhaustion.

## Conclusion

The bottom line is this: before implementing a rural development project, take the time to determine if the beneficiaries can afford or otherwise have access to sufficient calories and other essential dietary needs to complete the daily tasks expected of them. If not, compute the number of hours that can be expected and adjust the area over which the promoted technology can be extended within the anticipated time limits. It is really not a very time-consuming or complicated exercise, and could provide more realistic expectations of the potential for introduced technologies to expand across a production area. Be somewhat cautious about using hired labor. Often the casual labor pool consists of other farmers, who on any given day and for a variety of reasons opt for doing casual labor instead of working their own fields. Working as casual laborers will use significant amounts of energy and may leave these farmers depleted when it comes to working their own fields. As development change agents, the goal should be to increase well-being (economic and otherwise) across the host community, rather than to enhance one cooperating individual at the expense of others.

While it may seem trite to claim that you cannot expect a hungry person to work very hard, isn't that what the rural development effort has been doing for the past 40+ years? Until it is fully recognized and appreciated that smallholder farmers are most constrained by the availability of labor, and that the extent of this prevents them from obtaining the production potential allowed by the natural resource environment, there will be major limits on the long term sustainability of many development efforts.

# A Compendium of Free Online Courses, Books and Other Resources

*by Dawn Berkelaar*

No matter how much you have tried to learn before taking on an agriculture project, gaps in knowledge are inevitable. You might even be working in the area of agriculture without any formal training in the subject.

ECHO shares helpful agricultural information through our ECHOcommunity.org website, and we also offer courses in Tropical Agriculture at our Florida campus. Taking a course can be advantageous, because information is presented in a logical and sequential way. But people do not always have the resources needed to travel and take a course.

The internet is almost unbelievable in its power to make information widely available. It is also making information organized as coursework more and more accessible. In this article, we highlight a number of free opportunities for learning online.

## Online Courses

*Note that information in most of these courses will not necessarily be targeted to tropical agriculture. In the list below, the first few courses are marked TE (primarily temperate), TR (primarily tropical) or N (not primarily oriented toward any climate).

**Rodale Institute**. Rodale Institute has an online course for those who want to transition from conventional to organic farming. It includes sections on soils, crops and marketing. Even if you do not want organic certification in the USA, many of the principles will be helpful to people interested in learning about organic agriculture. N. www.rodaleinstitute.org/course

**Sustainable Agriculture Course from Sustainable Agriculture Research and Education (SARE)**. N. www.sare.org/Learning-Center/Courses-and-Curricula/National-Continuing-Education-Program/Course-1-Sustainable-Agriculture

**OpenCourseWare (OCW)**. More than 120 universities worldwide are part of the OpenCourseWare (OCW) movement. OCW provides free access to course materials that include "syllabi, video or audio lectures, notes, homework assignments, illustrations, and so on."

The OCW consortium includes many schools in the United States, including MIT (Massachusetts Institute of Technology), Tufts, Johns Hopkins, Michigan State, Michigan, Notre Dame and Utah State. Internationally, schools in China, Japan and Spain are part of the consortium. For information, see www.ocwconsortium.org and www.ocw.mit.edu. The sites allow users to search for relevant courses. Some that I thought looked interesting include: The Challenge of World Poverty; Food and Culture; Social Issues and GM [Genetically Modified] Crops; and Information Technology and Global Development. Some of the courses available through the MIT site have been translated into different languages.

**Open Culture** (www.openculture.com/freeonlinecourses). This site lists over 550 free online courses from some well-known and respected universities. The courses are from a wide range of disciplines. For example: