



Crop diversification: the 'old' weapon in the hands of Ethiopian farmers

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Wednesday, June 15, 2016

Ethiopian farmers have been faced with continuous outbreaks of virulent stem rust and yellow rust epidemics over the past decades, causing considerable damage and thousands of tons of wheat grain losses. A curious reader might wonder what caused this depressing outcome: was it the unpredictable rise of new devastating rust races? Or was it caused by a sudden change in farming practices? New research shows that the reasons for the rapid spread of these virulent races may be due to the newly adopted practice of repeatedly growing wheat crops one after another, namely monocultures. It is well known that the spread of rusts require fresh green wheat leaves to infect and survive. For each spore that completes an infection, millions of new spores are produced, which can in turn infect as many leaves. This cycle takes only seven to 12 days and it can be completed several times in a single season. Unfortunately, today's rural landscape of Ethiopia consists largely of a wheat monoculture as it is now grown in both the long (*meher*) and short (*belg*) rainy seasons, from the highlands to the valleys, ensuring the availability of green leaves for the pathogen to infect. The question is, why did this happen?

Ethiopia's annual production of wheat is not sufficient to meet the needs of the country, and large quantities are imported or obtained as food-aid each year. In 2005, the government launched a vision called the Growth and Transformation Plan (GTP) to increase national production of several key crops. Unfortunately, several 'minor' crops were excluded from this plan because of limited financial resources and therefore no measures were put in place to ensure their adequate profitability. The result was that many farmers abandoned these crops, favoring a monoculture of the 'major' and more profitable crops (i.e. wheat, maize, and others), creating an environment that was conducive for the rapid proliferation of diseases.

The Borlaug Global Rust Initiative (BGRI) initiative has mobilized large resources and catalyzed international collaborations towards breeding of wheat varieties that are resistant to the stem rust disease, as a means to ensure sustainability in this monoculture system. Ideally, varieties that are resistant will break the rust cycle and stop its spread. Additionally, foreign investments have accelerated the modernization of the seed system of Ethiopia, ensuring that the seeds of these new varieties can rapidly reach farmers. This is a fight between man and nature; the long term outcome remains to be seen.

Adding value to diversified cropping

Other initiatives have taken a different path to face the spread of rusts, focusing instead on promoting the cultivation of crops that are less susceptible to the diseases. In fact, before the recent shift towards wheat monoculture, the rural landscape was rich in that biodiversity for which Ethiopia is so famous. This included barley, local varieties of durum, potatoes, and several legumes. However, these crops were not supported by targeted policies and their market value declined making them less profitable to grow. The only way to reintroduce their cultivation is to recreate adequate market returns for farmers. In recent years this has been achieved. Clear examples of success in revamping the value chain have been the new life of the malt

industry for barley and the use of durum wheat for pasta, achieved through the combined efforts of the International Cooperation Agencies, CGIAR centers, Ethiopian Institute of Agricultural Research (EIAR), and Ethiopian industries.

Malt barley as a strategy for crop diversification



The value chain of malt barley was widely studied by the Research for Ethiopia's Agricultural Policies (REAP) and the International Food Policies Institute (IFPRI) to identify key policy changes to facilitate the 'path to market' of this product ([link \(http://reap.ifpri.info/files/2015/09/Barley_Value_Chain_in_Ethiopia_2015.pdf\)](http://reap.ifpri.info/files/2015/09/Barley_Value_Chain_in_Ethiopia_2015.pdf)). In 2009, a collaborative project between the International Center for the Agricultural Research in the Dry Areas (ICARDA), EIAR, Assela Malt Factory (AMF), and four local breweries (BGI, Meta Abo, Harar and Bedelle) delivered the release of 15 new high yielding malt barley varieties (Holker, Misccal 21, Sabini, IBON 174-3, HB 1963, HB1964, and several others) adapted to the Ethiopian agro-environmental

conditions (links [1 \(https://www.facebook.com/EIARPR/posts/432653976888664:0\)](https://www.facebook.com/EIARPR/posts/432653976888664:0), [2 \(http://www.icarda.org/update/building-resilient-and-gainful-livelihoods-barley#sthash.VVWY8bvL.dpbs\)](http://www.icarda.org/update/building-resilient-and-gainful-livelihoods-barley#sthash.VVWY8bvL.dpbs), [3 \(http://www.icarda.org/update/partnering-ethiopian-farmers-quick-deployment-malt-barley-and-grain-legume-varieties#sthash.MJAYOGGE.dpbs\)](http://www.icarda.org/update/partnering-ethiopian-farmers-quick-deployment-malt-barley-and-grain-legume-varieties#sthash.MJAYOGGE.dpbs), [4 \(https://icarda.org/update/scaling-out-malt-barley-and-grain-legume-technologies-ethiopia#sthash.42bsjchf.dpbs\)](https://icarda.org/update/scaling-out-malt-barley-and-grain-legume-technologies-ethiopia#sthash.42bsjchf.dpbs)). The yield levels of these varieties range from 3.5 to 6.0 tons per hectare, which is significantly higher than what is achieved by older non-malt varieties.

This pushed the production of malt in the Arsi region to more than 85,000 hectares by 2012, with an average annual growth rate of 11.4%. The production area has now expanded to Bale and western Shoa, including southwestern and northern Shoa. These areas are among the most affected by the virulent races of the wheat rust. In these areas farmers are now cultivating barley in rotation with wheat crops and making profitable returns. Furthermore, the barley crop is still widely consumed in the household as food; only the surplus is sold. Finally, barley straw is extremely important because it's used as animal feed.

Better pasta in Oromia for poverty reduction



In 2011, an intervention on the value chain of durum wheat in the Oromia region started within the Ethio-Italian Development Cooperation framework. All private and public interested stakeholders successfully collaborated under the technical assistance and guidance provided by Istituto Agronomico per l'Oltremare (IAO) and Sinana Agricultural Research Center (SARC), with ICARDA backstopping on breeding and technical issues. The result of bringing together producers from 15 cooperatives and 6 national pasta factories delivered a great economic impact. One of the key aspects for success was the development of a supply contract that recognized a higher monetary return to farmers for good quality grain, while

simultaneously ensuring ideal raw material for the pasta industry ([link \(https://www.youtube.com/watch?v=HOYa5iPmegA\)](https://www.youtube.com/watch?v=HOYa5iPmegA)). This was also made possible through the appropriate multiplication and diffusion of durum varieties with improved end-user quality and productivity ([link \(https://www.youtube.com/watch?v=S9sNLa-sCHM\)](https://www.youtube.com/watch?v=S9sNLa-sCHM)). In addition, in this case, farmers transitioned out of a wheat monoculture to include durum wheat in their rotations with bread wheat. Since the disease races that are aggressive on durum wheat are mostly different to those that affect bread wheat, and because durum tends to be more resistant to this disease, the value chain promoted more crop diversification and reduced the susceptibility of the system to rust. Smallholder farmers are now relying on durum wheat as a "rescue crop" protecting their entire livelihood system.

A new chance for value chain: more legumes for the short rainy season for better nutrition

Ethiopian farmers grow about a dozen legumes, including faba bean, chickpea, lentil, and grass pea, as crops in the cooler highlands. They grow the common bean, soya bean, cowpea, pigeon pea and mung bean in the warmer lowland parts of the country. Under a research partnership focused on food legumes (pulses), ICARDA is providing improved germplasm and



varieties of lentil, chickpea and faba bean to EIAR for testing on farmers' fields. To date, about a dozen improved varieties of lentil and chickpea, and 22 of faba bean, have been released with wide and specific adaptation in the country. This partnership has reaped rewards over the past decade in the Amhara and Oromiya regions where yields of

faba bean, chickpea and lentil have increased dramatically along with a steadily growing cultivated area. Pulses contribute to improving smallholder livelihoods through dietary diversification, better protein delivery, and ideal rotations for cereal based cropping systems.



Pulses are generally more profitable than cereals for farmers with limited land, as they fetch high prices in local markets. Faba bean provides the highest net return, followed by chickpea, malt barley, durum and tef ([link \(http://www.fao.org/3/a-at305e.pdf\)](http://www.fao.org/3/a-at305e.pdf)). As a result, pulses have emerged as the third-largest crop export of Ethiopia after coffee and oil seed, and represent a USD \$90 million export industry ([link \(https://www.youtube.com/watch?v=lOneNgM4Z2g\)](https://www.youtube.com/watch?v=lOneNgM4Z2g)). But there is still a need to fully connect rural producers with the national market in Addis Ababa, and ensure equitable profit shares. In this respect, Ethiopia still lacks a comprehensive strategy to intervene on the entire faba bean value chain, as has been the case for malt barley and durum wheat.



However, improvements through breeding has already been delivered ([link \(https://www.youtube.com/watch?v=9B7yNKOi4qI\)](https://www.youtube.com/watch?v=9B7yNKOi4qI)); hopefully the market will move to take full advantage of this.

In terms of ending rust epidemics, the re-adoption by farmers of legume cultivation will be one of the most important solutions in breaking the disease cycle associated with rusts. As these crops are non-hosts of the disease, provide biologically fixed nitrogen for a more sustainable agricultural practice, and fit perfectly in the short *belg* rainy season they represent significant positive outcomes for producers. The wide adoption of legumes cultivation in rotation with wheat would likely provide a larger impact than durum and malt barley combined, as legumes would end wheat monoculture cultivation and therefore significantly slow the rust cycle.

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