Greenhouse vegetable production in Brazil: current status and research needs[1]

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One of the main goals of modern greenhouse agriculture is planting the crops, usually vegetable and ornamental crops in periods (or places) in which the environmental conditions are not suitable for cultivation in the open field. In these periods, the supply of products in the market is lower and prices are consequently higher. Besides improving the control over the availability of nutrients and water and prevent the attack of pests and pathogens, protected cultivation also introduces some control over the physical environment to modify more or less drastically the temperature, humidity and light regimes. The practice however is not miraculous and good results depend on the proper management of the system.

Although the introduction of protected agriculture in Brazil is not recent, the continuous spread and development of this agricultural system began in the late 90s of the past century because when first introduced to the country, greenhouse horticulture was mistakenly divulged as a wonder system that would increase yields miraculously and there was little effort in educating potential growers on the correct management of the protected environment.

A growing interest in producing vegetables under protection is associated with the increasing income and urbanization of Brazilian population and the general concern with more secure food, the need to decrease the use of chemical pesticides and increase the efficiency of water and fertilizer use. There has also been a tendency to restrict the conversion of native land into agriculture land and the consequent necessity to increase agricultural productivity. Society demand has driven universities and research institutes, such as Embrapa, to develop scientific research and solutions as fastly as problems arise.

Brazil is the largest tropical country in the world and, as such, there is a great climatic and soil variability along its territory. Although protected horticultural production is practiced from southern subtropical Rio Grande do Sul to northern tropical rain Amazonia, the reasons why protected agriculture practices are adopted differ widely. Regional differences also present different challenges to the research sector because the solutions generated have to be climate-specific.

One example of that specificity are the modified greenhouses used in Northern Brazil, in which only plastic cover is maintained, without lateral walls. In that region, the limiting factor to horticultural production is excessive rainfall, so the modified greenhouse acts as 'umbrella'. The laterals of the greenhouses have to remain open, otherwise the heat built up inside would prevent production. Naturally, this kind of structure is more vulnerable to pests and there is a lack of information on how to manage those organisms without anti-insects screens and without the excessive use of pesticides.

Most of the greenhouse vegetable crops are still soil-grown. Although some growers fertilize the whole area of the greenhouse, this practice is relatively inefficient since

the application of water is usually done via localized irrigation systems, especially drip irrigation. Plants do not absorb nutrients from the areas that remain dry; the plants will absorb the nutrients only from the volume of soil moistened by drippers. In this case, it is much more rational and efficient to apply the nutrients via their own soluble fertilizer dissolved in irrigation water, a practice known as fertigation.

When used in a protected environment, such as greenhouses, fertigation poses the risk of soil salinization, for the same reason why it is advantageous: the lower nutrient losses. As there is generally no entry of rainwater or any excess water in protected cultivation, fertilizers used, which in general are salts, accumulate and increase the electrical conductivity of the soil solution, a classic indicator of salinity. This problem could be minimized by relatively simple practices such as increasing soil organic matter levels, green manuring and crop rotation, but growers are recalcitrant in adopting such practices. Another solution to this kind of problem is the adoption of soilless horticulture. Embrapa and other institutions have done much research on nutrition and irrigation management for soilless grown vegetables.

Despite difficulties, the area of vegetable production under protected cultivation in Brazil has been constantly increasing, already nearing 10.000 hectares. The research institutes have been responding to the sector's demands, but the size of the country and the different environmental conditions where protected horticulture is practiced makes the challenge even harder.