Commercial Substrates for Urban Agriculture in Bogotá

Blanca Arce
Andrés Peña

There is a need for low-cost, locally produced substrates for urban agricultural production in Bogotá, Colombia. The Colombian Agricultural Research Corporation (CORPOICA) coordinates participatory research on substrate mixtures using a wide variety of low-cost organic materials.

Urban agriculture is increasingly common in Bogotá, the capital of Colombia. Especially due to rural-to-urban migration, the percentage of Colombians living in cities rose from 40 per cent in 1951 to 75 per cent in 2005 (DANE, 2009). The poverty rate in many of the country’s cities is increasing and a growing proportion of urban residents encounter difficulties in securing access to food. In addition, there is an increase in demand for organically produced food and many inhabitants are prepared to pay more for the quality and safety that these products offer. Urban farmers are well positioned to take advantage of this lucrative market.

There are an estimated 4000 agricultural producers in Bogotá. In the periurban areas there are more than 300 hectares of highly productive vegetable gardens both in open fields and in greenhouses. In the city itself, though, mostly containers are used in open or closed spaces (backyards). These containers need substrate capable of maintaining continuous harvests, especially if they are used for the production of vegetables.

Peat is one of the most frequently used substrates in Bogotá, particularly for growing tomatoes and other vegetables. It is a natural product, containing 80 per cent organic matter that has many positive qualities including good water retention. It is free of pathogens and thus need not be disinfected. However, peat is imported from Canada and is very expensive (approximately USD 2/kg). It is more affordable for commercial producers who have extensive areas of production (10-30 ha) than for small producers who cultivate only small areas (0.5-2 ha). Small producers are more interested in cheaper, local substrates of high quality such as lime, compost, raw husk, scum (residue of burnt charcoal), burnt husk, charcoal-sand, solid humus, sawdust and urban waste compost.

Due to the high price of available substrates, mainly peat, there is a need for cheaper, locally produced, substrates (of the same high quality). In addition, recycling of locally available material reduces pollution and the cost of (urban) waste management. For instance, in warmer regions where sugar production dominates (Cachaza and Vinaza), the contamination of rivers and soils has been diminished by almost 60 per cent through the composting of industrial waste. This waste is utilised as substrate in vegetable production. And in Cajica City, under the organic waste recycling programme initiated in 2008, organic waste from all 11,000 households (50,000 citizens) is collected and converted into organic fertiliser for agricultural use. Local high school students teach households how to make the compost at home. Materials are provided by Cajica City, and the collected waste compost is used for organic fertiliser and animal feed.

A study was undertaken in 2009 to evaluate these locally available substrates, using mixtures from a wide variety of low-cost organic materials that could be used in urban agriculture.

The project

The urban agriculture project CORPOICA worked with three schools and households in three municipalities of the Department of Cundinamarca West Savannah of Bogotá: Funza, Facatativa and El Rosal. This involved 60 teachers, 90 students (from elementary school to high school) and 21 households. The project aimed at strengthening technological innovation and skills, by involving researchers, teachers, students and households in participatory planning and research (Photo 1).

The project involved the following steps.

- Working groups were organized comprising of researchers, teachers, students and farmers.
- A programme of technical-pedagogical training (with theory and practice) was created, based on agro-ecological guidelines and good agricultural practices.
- Urban and periurban horticultural spaces were designed in a participatory way (separately for each group in its own
environment) and in accordance with local, educational and socio-economic conditions.

- Vegetables were identified and agricultural techniques were discussed, adjusted and validated.
- Participants monitored the technological innovations.
- Didactic support material for technology transference was created, and urban agriculture was included in the curriculum of the elementary and the high school.
- Outreach activities were undertaken in ten cities around Bogotá, to disseminate the results achieved.

Six locally available substrates were evaluated (in PVC guttering): treated soil (lime, compost, raw husk), scum (residue of burnt charcoal), burnt husk, charcoal (together with sand at a ratio of 2:1), and solid humus (mixture of soil, solid humus and raw husk at a ratio of 2:1:1). The system of PVC gutters is ideal for use with crops that have a long growing cycle, as they provide a good accommodation for the roots, are low cost and save water and electricity.

The project looked at the performance of lettuce plants in different containers. Similar tests were done in the research centre, in three urban school gardens and in six urban home kitchen gardens. The substrates made up of two or more materials mixed together demonstrated better properties than those that only contained one element. Different techniques were also applied: rainwater harvesting, the use of various substrates including solid and liquid (only water and with nutrient solutions). It is important to have the right substrate mixture, and specific mixtures are needed for different vegetables. The nutrient solutions were composed of minor and major elements (chloride, sodium, sulphur, magnesium, calcium, potassium, iron, copper, bromine, zinc). These nutrient solutions when used in substrates are specially formulated to nurture the development of the plants, which have different needs depending on their stage of growth. They are easy to obtain and handle and they are cheaper than imported alternatives.

Main results

Through this project vegetable production in vessels and containers and in conventional organic gardens has improved in Bogotá. Various systems of production have been developed and recommended for growing urban crops in containers. For both containers and organic gardens, a training module has also been developed. The module for conventional organic gardens emphasises the efficient use of natural resources (soil, water) and environmental conservation (Photo 2). The module for vessels or containers includes a variety of different materials, such as PVC guttering, prefabricated roof material, fibre cement boards, black plastic bags, recycled soft drink bottles, wood; and in different set up: pyramidal, stepped and netted structures (see González Rojas, 2007: UAM no 19).

The substrates of raw husk and burnt husk were the least efficient because of their low moisture retention capacity and the difficulty of achieving homogeneous humidity. Rice husk is a sub-product of the milling industry, which is not available locally, so the main cost is transport. The mixtures using solid humus (combined with soil and raw husk) and compost (combined with lime and raw husk) had better characteristics in terms of germination rate of lettuce; moisture retention capacity; infiltration and drainage; contamination; colour of the crop; environmental conservation; cost and availability at local level; and quality. With these mixtures, the urban farmers obtained lettuce with a greater number of leaves and a higher fresh weight, thus leading to better earnings. The other types of substrate produced lettuce with nutritional deficiencies and thus led to lower quality and output. For more information see Tibaitatá-Corpoica research center (2009).

Substrates were tested in different technologies at the Tibaitatá research centre
Photo: Blanca Arce, Urban Agriculture Project-Corpoica, Colombia

The production of lettuce using these mixtures achieved results similar to those obtained with the use of commercial substrate. The disadvantage of the latter is that it is more expensive and comes in larger (25 kg) bags. These need to be stored, which is not good for the quality of the substrate. A mixture of compost with local products seems to be a good alternative in terms of price, performance and accessibility (it is easy to produce or buy in shops in the city).

Future

Teachers, students and households are replicating and adapting their vegetable production systems in built-up areas, including the design of their urban garden schools and household productive units. By using different containers, they can take better advantage of the scarce amount of space available, and plant a wider variety of species for their own consumption and for sale. In this way they have been able to improve their family’s diet, diversify their food patterns, and generate complementary income. Recommendations are being developed on the use of substrates containing compost and local sub-products. A growing use of compost will reduce the amount of waste in the city. The results are encouraging, but more research is needed on issues like transport, type of containers and vegetable varieties.

Blanca Arce, Andrés Peña
Colombian Agricultural Research Corporation (CORPOICA), Bogotá, Colombia
Email: barce@corpoica.org.co

References on page 52