SPILLING THE BEANS

DEBORAH DUTTA

Growing a food garden in school naturally provides a space for students to raise questions about and develop an integrated understanding of the local environment. However, many schools may have limited space for such a project. How do the principles of urban farming, a practice that has emerged from land-scarce megacities, help teachers and students to grow food in their schools?

"The single greatest lesson the garden teaches is that our relationship to the planet need not be zero-sum, and that as long as the sun still shines and people still can plan and plant, think and do, we can, if we bother to try, find ways to provide for ourselves without diminishing the world". —Michael Pollan.

Offering students authentic experiences of engaging with their immediate environment is increasingly being recognized as one of the most important aspects of environmental education. Growing a food garden as a school project naturally provides a space to raise questions and develop an integrated understanding of weather, food, nutrition, the economics of food production, water, and local geography. Harvesting edible plants can help supplement school kitchens as well as keep students invested in the project and derive a sense of achievement from it.

However, many schools may have limited space for such projects. It is in this context that urban farming can offer hope. Urban farming is the practice of growing food within available areas in urban and semiurban areas. It has emerged as an interesting alternative in 'megacities' like Mumbai that suffer from a severe scarcity of land (see **Box 1**). How can teachers and students adapt the principles of urban farming to grow food in available spaces in their own schools?

Space

Your school may not have the luxury of a backyard, but you will be surprised at how much can be grown even within modest structures or sites like the window sills or terrace of your school! You just need to tap into your creative side to design planters that are appropriate to the kind of space that you choose to convert into a garden (see **Table I**). Since the amount of labour and time needed for a food garden naturally increases with the amount of space you choose to work in, it is advisable to start small and keep increasing the number of plants as you and your students feel more confident.

Box 1. Why urban farming?

This practice has become increasingly popular for reasons ranging from food security and urban biodiversity to the need for recreational spaces. This is because urban farming not only eases the pressure on rural land and resources, but also offers a promising way to rebuild our connection to food—through local production and consumption. It allows us to revisit traditional farming knowledge while also exploring creative methods to grow food in smaller spaces. This is not all. Our farms can help enrich local biodiversity. Working on them can help us appreciate the joy and reciprocity of tending to the soil. Farming in a school can also be a way of building a sense of community. Importantly, cities are conventionally seen as a source of numerous environmental issues. We can change that narrative, and it can all start with a handful of soil.

Sunlight

Most plants require about 4-6 hours of sunlight. Balconies and rooftops may have a better chance of receiving ample sunlight. It may also be helpful to grow some common shade-tolerant plants, including herbs such as mint, basil, and celery. Root vegetables such as beet, onions, garlic, and radish also do well in partial shade.

You may need to observe the orientation of the sun to ensure that your plants receive more of the morning sun than the harsher afternoon sun. Any supports you make for climbers need to face the direction that receives the maximum sunlight since these plants tend to grow towards the light (positive phototropism). Since the path of the sun changes with seasons due to the tilt of the earth's axis (the highest arc being followed during the Summer Solstice), it might be necessary to move planters accordingly.

Planters

Many different kinds of planters are available in the market (see **Table II**). You and your students can also experiment with using grow bags, jute bags, old metal containers, rubber tires, plain cardboard boxes, or bags made from old clothes as planters (see **Fig. 1**). In general, a good planter should allow for aeration and the drainage of excess water. Care needs to be taken that the planters do not contain any harmful chemicals (such as the coloured pigments from print material) that can leach into the soil. The size of the planters that you need will depend on the plants you intend to grow. Smaller plants, such as herbs, can be grown in planters with a depth of 6-10 inches. Plants such as brinjal, chili, tomato, lady's fingers, and capsicum may require planters with a capacity of 10-20 L.

Table I. Pros and cons of potential sites.

Type of structure in the school	Pros	Cons
Window sills	A good place for germination in seed trays; and to grow creepers and green vegetables, if adequate sunlight is available. Easy to manage.	Cannot place bigger pots, as it can cause safety issues. Only a limited number of vegetables and greens can be grown.
Balcony or small terrace	Bigger containers can be used, after checking (with the building architects) for waterproofing and weight-bearing capacity of the floor. Planters can be moved around. Bigger plants can be grown.	Involves more work, depending on how many planters you would like to grow. This may include additional expenditure if waterproofing is not done.
Rooftops	With adequate load-bearing capacity and waterproofing, a large number of plants, including fruiting trees, can be grown. Helps cool the building by reducing the amount of sunlight hitting the roof.	Access to rooftops can be restricted in some school buildings. Need to ensure proper drainage of water. Since high-rises may be windy, additional structures to break the wind may be needed. Some shade may need to be built for plants that are sensitive to sunlight.
Backyard and/or the land all along the perimeter of the school within the compound	Fewer worries about soil and drainage. Trees can be grown without load-bearing considerations. You can also do pit composting, and use the compost easily.	Can be more prone to pests. Access can be restricted. Can be vulnerable to water logging during the monsoons if it is situated in a low-lying area.

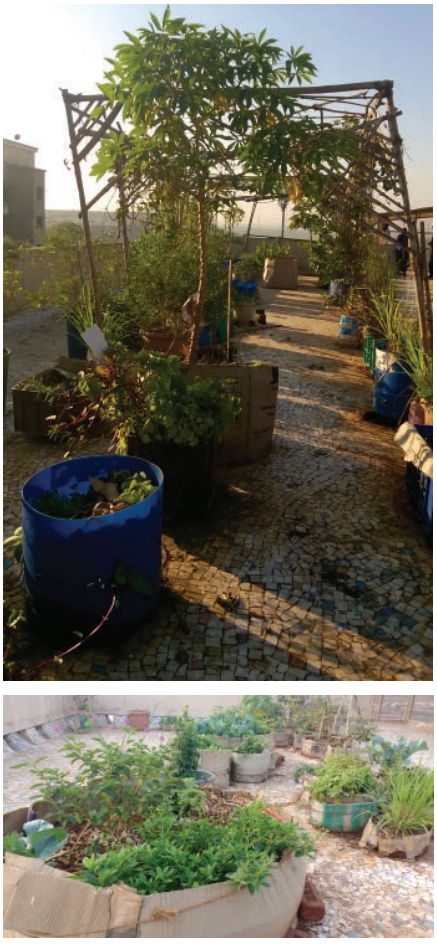

Fig. 1. Readily available material can be creatively repurposed into planters.

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Table II. Pros and cons of some common types of planters.

Planter type	Pros	Cons
Clay Pots	Easily available; provide natural aeration and drainage; thick walls prevent soil from heating up.	Need regular watering; heavy to move around; adds to the load on terraces, etc.
Plastic containers	Easily available; lightweight; can be upcycled from discarded waste.	Become brittle and prone to cracking under prolonged exposure to sunlight; tend to heat up; contribute to plastic consumption if buying new containers.
Wooden containers	Aesthetically appealing; larger containers can be designed to allow for multicropping.	Can be difficult to source (fruit sellers can have crates, especially during the mango season). Can leach toxins if the wood is painted, chemically treated, etc. Can be prone to termite infestation.
Raised beds (enclosed area of soil/compost that is higher than the surrounding area). A variety of materials, such as bricks, concrete blocks, wood, and bamboo, can be used to make the beds.	Once constructed, do not require much maintenance; can grow bigger plants together. Easy to control soil conditions and look out for pests.	Can be laborious to construct initially (depending on the building material).
Trellis or supports can be made from various materials, such as coir or nylon ropes or thin strips of wood.	Helps in the growth of creepers and climbers, such as gourds, and plants with weak stems, such as tomatoes and cluster beans.	Can be a little cumbersome to make initially.

Soil

Ideally, the soil for growing plants should be loose, fertile, of neutral pH (~7; neither acidic nor basic), and have good water retention (see **Fig. 2**). Soil fertility can be improved by adding kitchen compost, nutrient-rich soil organic matter (SOM) like Amrit-Mitti, Biochar, green manure, mulch, and natural fertilisers (see **Box 2**).

Seeds

It is advisable to choose seeds that nurture local biodiversity (see **Box 3**). As Hoidal (2015) writes, *"Seeds carry the genetic keys to biodiversity and climate change resilience, and are records of cultural knowledge, reflecting historical breeding practices".* Using organic open-pollinated seeds can help ensure that their mature fruits can be used to save seeds for the next sowing season (see **Box 4**).

Fig. 2. The soil for growing plants should be loose, fertile, have neutral pH, and have good water retention.

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Box 3. Choosing seeds that nurture local biodiversity:

We can help nurture local biodiversity by enhancing plant diversity at different levels:

- Growing different varieties of the same plant species (such as the round, long, purple, and green varieties of brinjals), but not next to each other.
- Growing plants of different species, with mutually beneficial or complementary characteristics, next to each other. This can take the form of growing tall plants with short plants, plants with fibrous roots with those with tap roots, plants with deep roots with those with shallow roots, or climbers with ground plants.

How does this help us? Different flowering plants attract different kinds of pollinators, such as butterflies and bees, and provide them with a habitat! In general, growing a diversity of plants also provides better pest control. This is because different plants can act as hosts for different kinds of insects, which can have mutual predator-prey relationships. Different kinds of insects are more likely to attract a diversity of lizard and bird species (that feed on insects), which can also help control pests.

Box 2. Ways to improve soil fertility:

(a) Kitchen compost: Food scraps are the easiest source of organic matter to enrich the soil (see **Fig. 3**). They can be composted using various methods (hot, cold, anaerobic, and vermicompost). Basically, composting is a process by which organic matter is broken down, under controlled conditions, into simpler constituents through microorganisms or fungi. Composting requires carbon (dry/ brown biomass), nitrogen (greens/ fresh biomass), oxygen (if aerobic), and water. You could use an aerated container with a lid (holes can be punched or drilled into the container or earthen pot), and simply layer food waste and dried leaves in a 1:2 ratio if the food waste is fresh. Sprinkle some red earth after every 2-3 layers. Turn the mixture every 10 days or so. When the container is full, keep it aside for about 15 days to complete the composting process. Compost has a dark, crumbly texture, and smells slightly sweet. While one can and should experiment with methods of composting, it is advisable to follow a tried and tested 'recipe' to begin with, so that the first cycle of success motivates you to try other options. More details and starter kits can be found here: https://dailydump.org/. The steps involved in composting are explained here: http://www.urbanleaves.org/2016/04/savealeaf-solution-2-composting.html.

Fig. 3. Food scraps from the school kitchen can be composted and added to soil to improve its fertility.

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(b) Amrit-Mitti (AM): This is a method of soil-building through composting of dried and green biomass using a microbe-rich mixture of cow dung, cow-urine, and jaggery. The resulting soil is rich in nutrients and organic carbon, lending it a dark, crumbly texture. Since AM weighs less compared to red soil, it is an ideal plant medium for balconies, rooftops, etc. A detailed description of AM and the steps involved in its preparation can be found at the Urban Leaves (a community farming group in Mumbai) website: http://purvita10.wixsite.com/urbanleaves/booklets.

(c) Biochar: When organic matter is burnt slowly under a limited supply of oxygen, it produces highly porous charcoal. When this is added to soil, it helps retain nutrients and water (see **Fig. 4**). If difficult to make due to lack of space, commercially available charcoal in local shops can be used instead.

Fig. 4. Preparing biochar in a pot.

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(d) Mulch: Mulching is the process of covering topsoil with a thin layer of organic matter. This prevents soil from compaction due to heat, heavy rain, cold weather, etc. Usually dried, crushed leaves, bagasse (make friends with the neighbouring sugar cane seller!), straw (look out for the mango season since plenty of ready-to-use crates of straw can be salvaged!), etc., can be used (see **Fig. 5**). Cover crops, also known as live mulch, can be used. These include members of the legume family, such as alfalfa, clover, mimosa, beans, and peas.

Fig. 5. Plant mulched with dried bagasse.

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(e) Natural fertilizers: Plants usually need macronutrients, such as nitrogen, potassium, and phosphorous, for their growth. The presence of trace elements like boron, magnesium, zinc, and molybdenum is also important.

Alternatives	What it contributes to the soil
Ground coffee and fresh grass cuttings	Good sources of nitrogen.
Planting legumes in the vicinity	Helps fix nitrogen.
Rock phosphate and crushed bones (of animals) or prawn shells	Good sources of phosphorous. Especially important for fruiting plants.
Egg shells and Epsom salt	Good sources of potassium. Especially needed for proper leaf growth and disease resistance.
Wood ash or the residue left after burning wood	Rich source of phosphorous. But since it is alkaline in nature and can alter the soil pH, care should be taken to avoid overuse as it can cause other problems in the soil and in plant growth.

Box 4. Saving seeds:

Why save seeds? In most cultures, seeds are considered sacred because they symbolise the potential and fertility of life. A single seed can give rise to a million more given the right conditions in the environment. Each of us has the right to save seeds, even though this right is becoming increasingly threatened due to patents by agribusiness companies that sell seeds, thereby making farmers dependent on such companies to continue growing crops. When we save seeds, we strengthen local diversity (of plants that grow best in the conditions specific to our immediate environment) and our ability to freely use and exchange seeds and the knowledge (including traditions and folk wisdom) associated with them with other farmers across generations. This ability is called seed sovereignty. According to Vandana Shiva (2012), seed sovereignty *"includes the farmer's rights to save, breed and exchange seeds, to have access to diverse open-source seeds which can be saved—and which are not patented, genetically modified, owned or controlled by emerging seed giants. It is based on reclaiming seeds and biodiversity as commons and public good".*

How do we save seeds? This can be very plant-specific. However, general guidelines include selecting a healthy plant with minimal stress and disease. The fruit of this plant should be allowed to ripen and mature completely. Seeds from some plants (such as tomato, brinjal, and gourds) are 'wet' and will need to be separated from the pulp. In fact, seeds of tomato and some gourds are best stored after fermentation. Seeds of cruciferous vegetables (like radish, cabbage, cauliflower, and mustard) can be saved by collecting dried pods of the plant. Herbs (such as basil, mint, and spearmint) can be propagated from cuttings. More details on seed saving can be accessed here: http://203.64.245.61/web_docs/manuals/save-your-own-veg-seed.pdf.

(a) Sowing: It is advisable to sow seeds in small containers with loose potting mix. This offers two advantages:

- It allows you to control temperature, moisture, and sunlight during germination. Young saplings may also need to be protected from harsh sunlight.
- It reduces damage to germinating seeds by soil pests.

The potting mix consists of cocopeat (which is composted coconut fibre), sand, and compost. The small containers can be made from perforated plastic bags, Tetra Paks, curd containers, egg shells, and so on. It is also good practice to label the seeds (with, for example, ice cream sticks) so that you can keep track of the germinated plants.

(b) Transplanting: A sapling can be transplanted into a bigger pot once a few leaves have sprouted (remember, the first two leaves are called false leaves; they are part of the seed embryo). Doing this in the evening will allow the plant time to adjust before it is exposed to sunlight. Care should be taken to avoid damaging the roots. Some wood ash can be added to the soil to protect the roots from fungal infection in the time it takes for them to adjust to the new soil medium.

Fig. 6. Students observing their tomato plants to check for ripe fruits.
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(c) Harvesting: Harvesting for consumption should be done when the vegetable or fruit is mature, but not overripe (see **Fig. 6**). For many plants, this stage can be identified visually or by touch. For some plants, you may need to look for other indications of when the vegetable or fruit is ready for harvesting. For example, a radish is ready for harvesting when some part of it can be seen above the soil. Turmeric and ginger have a maturing period of around 10 months (they need very little water in the last month), and are ready to be harvested when the leaves dry up.

Water

Watering plants can be like a zen practice—seemingly easy, yet ridiculously hard to master. Too little can stunt plant growth, and too much can cause root rot, fungal infections, etc. Usually, it is good practice to stick your finger in the

soil to check how wet it is. If it feels dry, water the soil. This is best done early morning or evening when the soil is less likely to lose water through evaporation and the plant roots are more likely to be able to absorb water from the soil. You can also explore self-watering systems like drip irrigation. This may be particularly helpful when the school is closed for winter or summer breaks. To save water, you may want to explore rainwater harvesting and recycling of grey water. For example, if your school uses eco-friendly washing materials, such as soap nuts, you can use the wastewater from kitchen sinks, showers, washing machines, etc., for your garden.

Digging deeper

(a) Tilling: Occasional tilling of larger pots may be needed if you feel that the soil seems hard and clumpy. Use a prong or shovel to dig slightly and loosen the soil. Avoid areas near the main stem. Top the tilled area with mulch, sprinkle some wood ash, and water slightly.

(b) Pruning: This refers to the removal of dead, infected, or overgrown plant parts. Pruning can result in better growth and yield. However, this requires some expertise because doing it incorrectly can injure the plant and be counterproductive. It is safer to remove pest-infected parts of a plant to prevent further disease. While handling a healthy plant, however, it is better to consult more experienced farmers. 'Pinching' refers to the removal of immature fruit or buds using your fingers. This is usually done to encourage growth in tomatoes, basil, amaranth, etc.

Pest attacks

In the event of a pest infestation, it may be better to give the plant some time to recover under observation rather than immediately treating it with pesticides (organic or synthetic). This approach to pest attacks is similar to giving a person time to naturally fight a fever rather than prematurely loading them up with high doses of antibiotics.

More often than not, the infected plant will recover and show resistance to other such attacks. If pesticides need to be used, it may be better to use natural pesticides sparingly and only after ensuring that other methods (like washing the infected parts and pruning) have not worked. Remember, the indiscriminate use of pesticides can have adverse effects (like the pest developing resistance to the pesticide).

Parting thoughts

In the end, food farming is about relationships. It is an embodied way of understanding the way in which connections between the air, soil, water, sun, plant, and other creatures nourish our life. It can also be a powerful and effective way to adapt to a changing climate. While most environmental actions are imagined on a very small (individual) or a very large (countries, governments) scale, more often than not, community-based approaches can result in long-term, impactful changes in society by creating alternate cultural norms and practices.

Reflecting on the transformative potential of gardening, author Rebecca Solnit writes: *"To garden is to make whole again what has been shattered: The relationship in which you are both producer and consumers, in which you reap the bounty of the earth directly, in which you understand fully how something came into being. It may not be significant in scale, but even if it's a windowsill geranium high above a city street, it can be significant in meaning".* Let plants be the teachers of reciprocity and resilience. There is much to learn from them.

Key takeaways

- Growing a food garden as a school project naturally provides a space to raise questions about and develop an integrated understanding of nutrition, the economics of food production, the weather, water, and local geography.
- Schools that have limited space can draw upon principles of urban farming (a practice that has evolved to meet the need to grow food in land-scarce cities) to engage in such a project.
- Some of the most important factors to consider in growing a food garden are space, sunlight, planters, seeds, and water.
- A surprisingly large amount of food can be grown even within modest structures or sites like the window sills or terrace of your school. It may be helpful to start with a small space, keeping in mind some of the most likely pros and cons that it offers.
- The amount of sunlight, its orientation during the day, and its path during different seasons can vary depending on the space you choose for your food garden. It may be helpful to choose plants appropriate to these variations and move planters around when necessary.

- Planters should allow for aeration and the drainage of excess water. These can be obtained either commercially or repurposed from readily available materials like grow bags, jute bags, old metal containers, rubber tires, plain cardboard boxes, or bags made from old clothes.
- The soil for growing plants should be loose, fertile, of neutral pH, and have good water retention. Its fertility can be improved by adding kitchen compost, nutrient-rich soil organic matter (SOM) like Amrit-Mitti, Biochar, green manure, mulch, and natural fertilisers.
- Using local organic open-pollinated seeds of different varieties of the same plant or different species of plants that complement each other can help nurture local biodiversity. Using plant-specific seed-saving methods can help ensure that mature fruits can be used to save seeds for the next sowing season.
- Determining the correct amount of water for each plant in the food garden may require careful observation of soil moisture. It may be helpful to explore self-watering systems (like drip irrigation) and water-saving systems (like rainwater harvesting, and recycling of grey water).
- Food farming, even at a small scale, can offer an embodied way of understanding the way in which connections between the air, soil, water, sun, plant, and other creatures nourish our life. It can also be a powerful and effective way to adapt to a changing climate.

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References:

1. Dutta D (2023). Nurturing spaces for wild ideas. Teacher Plus. April. URL: https://www.teacherplus.org/nurturing-spaces-for-wild-ideas/.
2. Dutta D & Hazra A (2023). Cultivating Hope: Food growing possibilities in Indian cities. TESF India, IIHS. URL: https://tesfindia.iihs.co.in/06_there-is-a-bee-in-my-balcony/.
3. Dutta D (2019) Pedagogy of 'dirty' hands: reflections from an urban terrace farm. i wonder.... pp. 72-81. ISSN 2582-1636. URL: https://publications.azimpremjiuniversity.edu.in/2106/.
4. Hoidal N (2015). What's in a seed? The critical role of seed politics in the food sovereignty movement. Sustainable Food Trust. URL: https://sustainablefoodtrust.org/news-views/food-sovereignty-seed/.
5. Ladner P (2011). The urban food revolution: Changing the way we feed cities. New Society Publishers.
6. Tracey D (2011). Urban agriculture: ideas and designs for the new food revolution. New Society Publishers.
7. Alvares C (2009). Organic Farming Source Book. Other India Press. URL: https://www.twn.my/title2/books/organic.farming.sourcebook.htm.

Other resources:

1. Sources for conducting farming projects in schools: The Edible Schoolyard Project. URL: https://edibleschoolyard.org/.
2. Bookstore for reading on various environment-related topics, especially in the Indian context: Earthcare Books. URL: http://earthcarebooks.com/.
3. Network of organic farmers in India: Organic Farming Association of India. URL: http://ofai.org/.

Deborah Dutta is an educator and researcher. She has a PhD from the Homi Bhabha Centre for Science Education (HBCSE), Mumbai. Deborah is deeply interested in the interplay between educational processes, sustainable practices, and socio-technical systems.