



ORIGINAL ARTICLE

Production of Biological Pots: a Strategy for Useful Utilization of Sugar cane Bagasse in Khuzestan Province

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ABSTRACT

Given the physical and chemical properties of sugar cane bagasse, it can be a seedbed in the form of pots for producing and keeping seedlings until they are transplanted in the fields. This will be a logical and useful way of optimal utilization of bagasse too. Bagasse increases the productivity and fertility of soils without causing them any harm, and provides a suitable place for the growth of microorganisms that play an important role in improving soil structure. However, until necessary conditions and facilities are provided for processing bagasse, the loss of this useful material, and the harmful effects of this loss on the environment, will be unavoidable. That is why, given the importance of this issue, any action taken in using bagasse and in preventing its burning, even in a limited scale, will be an important step in turning bagasse into a useful material. This is the reason why we have considered utilization of bagasse in manufacturing, and extensive use of, biodegradable pots. These pots will provide a suitable and useful environment for growing greenhouse plants and will reduce environmental pollution that results from burning bagasse.

Keywords: Bagasse, biodegradable pot, sugar cane

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INTRODUCTION

The twenty first century should be defined as the era of making comprehensive efforts in reducing environmental pollutants in human communities, especially in developing countries, because third world countries are gradually drowning in the garbage dumps created by these pollutants and are endangering both their present and their future generations [7]. Based on available statistics, each person produces, on the average, 1.5 kilograms of waste every day. In a town with a population of 200000, 300 tons of waste per day, or more than 100000 tons of waste per year, is produced. Unfortunately, in most developing countries, waste disposal is, for various reasons, non-normative and most of it is buried near urban areas or a large part of it is abandoned on the outskirts of towns. The physical and chemical composition of waste are very diverse and depend on the different seasons of the year, the population, the daily consumption, the life styles, and the culture of the people who produce waste [1]. Sources of waste production are varied too and consist mainly of waste produced at homes, in public places, institutes, industrial units, building construction, and in food production factories [4].

Sugar cane bagasse

Bagasse is sugar cane pulp left as dry compact fibrous masses in the form of small straw-yellow colored pieces after sugar extraction. Its chemical composition consists of 32-48% cellulose, 19-24% hemicellulose, 3.22-5.5% ash, 0.73-0.97% sulfur, and 0.73-0.97% potassium.

Because of its special physical and chemical structures, bagasse has various applications in Iran (and in other countries). It is used in steam and electricity production, (in its compacted form) as a substitute for fuel wood, and in charcoal, methane (biogas), domestic gas and methanol, paper pulp and paper, fiberboards, and compost (organic matter) production [8].

Bagasse Production in Iran in 2013 (up to the first 12 days of the third month of fall)

Bagasse, which constitutes more than 34 percent of the weight of sugar cane, is produced in Khuzestan Province as follows [8].

1. Imam Khomeini Agro-Industrial Complex: 66334 tons

2. Dehkhoda Agro-Industrial Complex: 90733 tons
3. Amirkabir Agro-Industrial Complex: 24259 tons
4. Mirza Koochak Khan Agro-Industrial Complex: 41284 tons
5. Da'bal Khazae Agro-Industrial Complex: 31077 tons
6. Salman Farsi Agro-Industrial Complex: 39383 tons
7. Hakim Farabi Agro-Industrial Complex: 63542 tons
8. Karun Agro-Industrial Complex: 75295 tons
9. Haft Tappeh Agro-Industrial Complex: 54690 tons

Therefore, in 2013, up to the 12th day of the third month of fall, a total of 486596 tons of bagasse was produced in the country. Only 50 percent of this bagasse is used in feed plants and in chipboard production and the rest is dumped or abandoned in the deserts of Khuzestan Province, the main part of which spontaneously catches fire after a few days polluting the environment [3].

One notable potential use of bagasse is composting it because bagasse compost or bagasse organic fertilizer increases soil productivity and fertility and, due to its high organic matter content, is a suitable material for the growth of microorganisms that play an important role in soil structure and texture improvement. Therefore, using bagasse to make biological pots as a suitable and useful environment for growing greenhouse plants can be an optimal use of this material. In what follows, the use of these biological pots is briefly described [2].

Use of Biological Pots Made of Sugar Cane bagasse

Many farmers and managers of greenhouses use bags or glasses made of plastic for the initial growth of seeds. At the time of transplanting, the seedlings together with the plastic bags are transferred to the fields, or these bags and glasses are removed and only the plants and the soil around the roots are transferred to the fields. In either case, the used plastic is buried in the ground or left on the ground as waste. Pots made of sugar cane bagasse are in various shapes and sizes and can replace plastic pots of the same size that are used for growing greenhouse plants and seedlings. One of the important factors concerning materials used in making these pots is that, besides bagasse (which forms the main material) fertilizers required by plants will be available to their roots at the right time. For different plants, recommended fertilizers can be incorporated in the main body of the pots so that plants will not need any top dressing after germination (and no fertilizer will be lost through leaching). These pots are made of degradable materials, especially of sugar cane bagasse, and will not leave any undesirable waste behind but rather will provide suitable seedbeds for plants.

The manufacture of these pots will be an economic advantage in that, instead of losing a large part of the bagasse produced every year, it can be used in the production of pots. The use of these pots as a vegetative raw material in the planting and production of crop plants can be very effective in making optimal use of bagasse and in reducing environmental pollution.

Samples Made

Figure 1: shows two samples of pots made of sugar cane bagasse.



Figure 1: Pots made of sugar cane bagasse

Comparison of Pots Made in Iran with Those Manufactured in Foreign Countries

Properties of pots made in Iran and in foreign countries, such as resistance against crumpling and against tearing under tensile stress and shock tolerance, were compared qualitatively and only through direct observance and by touching the pots by hand without using any special equipment. The domestic pots and those made abroad were obviously different with respect to physical consistency, but this property was also compared through touching the pots by hand without using any special equipment (Figure 2).



Figure 2: Pot made of bagasse in Iran and sowing cucumber

Evaluation of Bagasse Pots for Growing and Transplanting Seedlings

Seeds of plants such as watermelon, cucumber, eggplant, and tomato were planted in manufactured bagasse pots in a greenhouse to evaluate their performance in growing seedlings. A mixture of aeolian sand and leaf soil with a weight ratio of 2:1 was used as the seedbed in these pots, which were kept and irrigated like other ordinary pots in the greenhouse of the College of Agriculture (Figure 3). Every day, during the first two weeks, we monitored seed germination, growth, and the general conditions of the seedlings. During the 12th to the 16th day, when the seedlings had reached the desired height, we transplanted them in furrows in the fields and frequently monitored them for three consecutive weeks to make sure they were growing normally.



Figure 3: Planting seeds in pots, and seedlings at the two-leaf stage before being transplanted in the field.

The Purposes of Using Biological Pots Made of Sugar Cane bagasse

1. Preserving the health of the environment: These pots are biodegradable. Only bagasse, that is biodegradable, is used in making these pots and, hence, no undesirable residues are left behind.
2. Improving plant nutrition through releasing elements contained in the pots: Since necessary elements can easily be incorporated in the body of the pots, these elements will be available to, and absorbed by, plant roots after transplanting. This will save the cost of top dressing too.
3. Preserving moisture equilibrium around plant roots: The bagasse in these pots is porous and hygroscopic; therefore, it creates better moisture equilibrium around plant roots under normal soil conditions.
4. Increasing soil porosity and improving root respiration: Pots made of sugar cane bagasse (that contains cellulose) act as organic fertilizers or organic matters that are added to soils: they increase soil porosity and improve root perspiration.
5. Increasing soil organic matter, decreasing stickiness of clay soils: Manure or organic matters of plant origin are added to clay soils to increase their infiltrability and reduce the stickiness of clay particles. Bagasse pots play a similar role because of their cellulose content.
6. Reducing the degree of leaching of nutrients in light and sandy soils: Manure or organic matter of plant origin is added to light and sandy soils to reduce infiltrability and increase the stickiness of soil particles. These pots, because of their nature and the organic matter they contain, increase retention of moisture and soil nutrients and reduce the degree of leaching of nutrients.

Feasibility of Establishing Facilities for Bagasse Pot Production in Khuzestan Province

Given the ease of obtaining the required raw material, job creation, reduction of damage to the environment, and other advantages resulting from the use of these pots, we suggest authorities in the province encourage and support the establishment of facilities to produce bagasse pots. Since bagasse pots are unknown to potential users (agricultural production and research institutes, greenhouse owners, especially those growing cucumbers, nursery managers, tissue culture centers, and agricultural colleges), it is necessary to convey the necessary information regarding the characteristics of these pots to them through preparing brochures, and by using promotional programs in public media. The required technology and equipment for producing bagasse pots are similar to those needed in the production of corrugated cardboard egg boxes (with some modifications); and the costs of making these boxes and bagasse pots per unit weight are comparable too. It is even possible for producers of these boxes to add a new assembly line dedicated to the production of bagasse pots.

As for the comparison of the total costs of producing bagasse pots of the dimensions of 12 by 15 centimeters and plastic pots of the same size, bagasse pots seem to be cheaper at present. The total costs of obtaining raw materials for producing one bagasse pot is estimated to be about 15 tomans, while the price of each plastic pot of the same size (that is presently used by greenhouse cucumber producers) is 500 to 800 Rials. Of course, this comparison of total costs involved in producing bagasse and plastic pots is not scientifically valid since many criteria must be taken into account for making this comparison. However, it seems mass production of bagasse pots, given the ease and low cost of obtaining raw materials and the fact that foreign currency is not required in procuring them, is a positive point in the evaluation of the production of bagasse pots. Compost, or compost soil, is a by-product of bagasse pot production, and this by itself will reduce production costs because it is easy to produce compost and no expensive and complicated technologies are needed for producing it.

Given the growing environmental pollution and destruction in third world countries, including Iran, it is necessary to encourage researchers, farmers, industrialists, and mass producers of consumer goods to carry out such projects in order to protect the environment [5]. At present, environmental activists are taking ongoing legal action against big factories to receive compensations for damages they inflict on the environment in producing their products, and are putting pressure on these factories to correct their production processes. If, once in the past, the production of disposable plastic containers (like soft drink containers) was a source of technological pride, in recent years, due to the increase in public awareness and because of the rising quantity of plastic waste in the environment, their production is considered a technological disgrace. Attempts to prevent further environmental pollution must be the concern of all those are aware of the dangers posed by pollution and who think of the health of future children of the earth because "the environment is not a legacy of the past generations, it is something we hold in trust for future generations" [6]. Given the physical and chemical properties of sugar cane bagasse, its use as seedbeds in the form of bagasse pots can be a major, and useful, solution for the problem of preparing seedlings and keeping them until they are transplanted to the fields, and a logical and profitable way of making optimal use of sugar cane bagasse [9].

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