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EFFECTIVENESS OF GROUNDNUT HAULM COMPOST (GHC) ON THE ESCALATION AND YIELD OF GROUNDNUT

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Abstract

India is a fast developing country and has a great challenge to meet the requirements of its high population. The human population of the country is increasing at the alarming rate. There is an urgent need to increase the food production of the nation to cope up with the increasing population. Today, global agriculture is at crossroads and this is the consequence of climatic change, increased population pressure and detrimental environmental impacts and new mechanism must be foundto ensure food security through sustainable crop production system that will supply adequate nutrition without harming the agro-ecosystem.Hence, the present study focuses to give a view about effectiveness of Groundnut Haulm Compost (GHC) on the escalation and yield of groundnut and the study based on both primary and secondary data collection.

Keywords*: Requirements of High Population, Food Production, Global Agriculture, Climatic Change, Increased Population Pressure, Agro-Ecosystem and Detrimental Environmental Impacts.*

Introduction

In recent years due to over exploitation of natural resources bio-fertilizer have emerged as an important component of incorporated nutrient supply system and hold assure for reducing the production costs, improve the crop yields, quality, nutrient provisions and sustaining the productivity over a longer period. The bio-fertilizers may be of immense use in the cultivation of crop plants. The resources may moderate in near future and the costs of fertilizer, is likely that these bio-fertilizers will definitely prove to be of economic value. These have the potential to replace part of the requirement of N and P fertilizers in the field and thus reduce the cost of plantation and establishment. With the growing interest on the application of bio-fertilizers, it is well established that it will increase the productivity of a wide range of crops.

Utilize of chemical fertilizers has increased worldwide for cereal production due to availability of inexpensive fertilizers. The continued use of chemical fertilizers causes health and environmental hazards. Use of organic wastes in agriculture is well known but the idea is not widely accepted due to some boundaries. Effective use of organic wastes is an important issue in developing countries.Crop residues are the non-economic plant parts that are left in the field after harvest. The harvest refuses include straws, stubble, Stover and haulms of different crops. Crop remains are also from thrashing sheds or that are discarded during processing this includes process wastes like groundnut shell. The greatest

potential as a biomass resource appears to be from the field residues of some crop plants in Tamil Nadu.

Groundnut (*Arachishypogaea*L.) widely distributed, originated from Brazil and has spread, to many tropical and subtropical countries of the world. It belongs to the Leguminaceae family, as annual herb. Its importance lies in the fact that it forms a major raw material for many agro industries. The seeds contain large amount of fats (up to 60%) and proteins (up to 45%). The nuts are eaten raw, boiled or roasted. A favourable dish is prepared from groundnut and both the leaves and nuts are used in soap preparation. Groundnut cake containing high protein forms the best feed and an excellent fodder for livestock.

Groundnut

Groundnut is grown on nearly 23.95 million ha worldwide with the total production of 36.45 million tons and an average yield of 1520 kg/ha in 2009 (FAOSTAT 2011). China, India, Nigeria, USA and Myanmar are the major groundnut growing countries. Developing countries in Asia, Africa and South America account for over 97% of world groundnut area and 95% of total production. Production is concentrated in Asia (50% of global area and 64% of global production) and Africa (46% of global area and 28% of global production), where the crop is grown mostly by smallholder farmers under rainfed conditions with limited inputs. Between 2000 and 2009, the annual global production increased marginally by 0.4%, the area by 0.3% and yield by 0.1%

Groundnut Production Chart

China leads in production of groundnuts/peanuts, having a share of about 42% of overall world production, followed by India (12%) and the United States of America (8%).

Top producers of groundnuts/peanuts in 2012	
Country	**Production (million metric tons)**
People's Republic of China	16.7
India	5.0
United States	3.1
Nigeria	3.1
Burma	1.4
Indonesia	1.2
Argentina	1.0
World	**40.1**
Source: USDA Foreign Agricultural Service: Table 13 Peanut Area, Yield, and Production	

Materials and Methods

Collection of materials

The groundnut haulm was collected from agricultural filed inArunagirimangalam Village,ThiruvannamalaiDistrict. The earth warm sp collected from locally agro private center in Dharmapuri District. Rhizobium, Azotobacter, Azospirillum and Phosphobacteriawere obtained from the Department of Agricultural Microbiology, Tamil Nadu Agriculture University (TNAU), India.

Seed Materials

The seeds of groundnut (Arachishypogaea (L.)were obtained from Regional Oil Research Institute, TNAU, Periyar Nagar at Virudhachalamtaluk, Cuddalore district, Tamil Nadu, India.

Preparation of Haulm Compost

The ground haulmswere selected and collected from the agricultural field in Arunagirimangalam Village, Thiruvanamalai District for making haulm compost. Well decomposed FYM was mixed with haulm compost.

The harvested groundnut plants (To remove the groundnut pods)is called 'Haulm'were collected from nursery and used for preparation of compost. The plant materials as well as Ragi straw were chopped well. The substrates were piled loosely in a compost pit and bulky in nature which provide better aeration within the heap. The material was too compact and no heavy weights were put on top. Aeration was provided by placing perforated bamboo trunks horizontally and at regular intervals, to carry air through the compost heap. The earth warm *sp*was added to the compost heap for best decomposition. The amount of activator used was usually 1% of the total weight of the substrates (cuevas, 1997). Heat was maintained at 50°C or higher and the heap was turned over every 5 days for the first 2 weeks and thereafter once in every 2 weeks. Turning over the pile provided adequateaeration and evened up the rate of decomposition throughout the quantity. By the end of the 3rd month, the compost was ready for use. It was dark brown, crumbly and had an earthy aroma. The physicochemical characteristics of the experimental soil and the nutrient contents of the selected haulm compost.

Experimental Site

The experiment was carried out at Arunagirimangalam village ThiruvanamalaiDisrtict. The experiment outline was entirely randomized block design, with three repetitions.

Field preparation

The field was ploughed with tractor drawn disc plough followed by a thorough harrowing to break the clods. The field was properly leveled and each plot (2.5 × 2.5 m size) was earmarked with raised bunds all around to minimize the movement of nutrient. Channels were laid to facilitate irrigation to plots individually.

Methods

Uniform sized and healthy seeds of groundnut were selectedfor the field experiments. The seeds were sown in soil mixed with different proportion of haulm compost and microorganismsapplication.

Seed Treatments

The seed treatment was given with carbendazim @ 2 g for 1 kg of seed in order to protect from seed born diseases.

Bio-fertilizer inoculation

For experiment purpose, biofertilizers(Rhizobium, Azotobacter, Azospirillumand Phosphobacteria)were mixed with sand (10 kg/acre) and applied to the field.
The following treatments

T_1	:	Control
T_3	:	1 tonne ha^{-1} haulm compost
T_4	:	1 tonne ha^{-1} haulm compost + *Rhizobium*
T_5	:	2 tonnes ha^{-1} haulm compost
T_6	:	2 tonnes ha^{-1} haulm compost + *Azotobacter,*
T_7	:	3 tonnes ha^{-1} haulm compost
T_8	:	3 tonnes ha^{-1} haulm compost + *Azospirillum*
T_9	:	4 tonnes ha^{-1} haulm compost
T_{10}	:	4 tonnes ha^{-1} haulm compost + Phosphobacteria
T_{11}	:	5 tonnes ha^{-1} haulm compost
T_{12}	:	5 tonnes ha^{-1} haulm compost + FYM

Irrigation Schedule

Pre-sowing irrigation was given to ensure uniform germination. Irrigation was given at 2 days with due care to avoid excess flooding of water. Uniform irrigation was given for a five times per a week. Five plant samples were randomly collected at regular intervals (15, 30, 60 and 90 DAS) and they were used for observations of morphological parameters like root length, shoot length, root nodules, total leaf area, fresh weight and dry weight of the plants.

Morphological Parameters

Shoot length and root length

Five plants were randomly selected for recording the root length and shoot length of crop plants. They were measured by using centimetre scale.

Total leaf area (Kalra and Dhiman, 1977)

Five plant samples were collected at various sampling days and the length and breadth of the leaf samples were measured and recorded. The total leaf area was calculated by using the Kemp's constant.

Total leaf area = $L \times B \times K$

Where, L - length, B - breadth and K - Kemp's constant (for dicot - 0.66).

Root nodules

Five plants from each pot with intact roots were removed with the help of digging fork. The root nodules were carefully separated from the soil by gently pinching and washing the soil. The following characters were recorded.

Fresh weight and dry weight

Five plant samples were randomly selected at regular intervals at (7, 15 and 30). They were separated into root and shoot. Their fresh weight was taken by using an electrical single pan balance. The fresh plant materials were kept in a hot air oven at 80°C for 24hr and then their dry weight were also determined.

Weed management

Hand weeding was done two times at 15^{th} days after sowing in order to remove the weeds from the field.

Biochemical analyses

The photosynthetic pigments such as chlorophyll a, b, total chlorophyll (Arnon, 1949) and carotenoid (Kirk and Allen, 1965) and the biochemical contents such as protein (Lowry et al., 1951), amino acids (Moore and Stein, 1948) and sugars (Nelson, 1944) (reducing, non-reducing and total sugars) were analysed in the plants grown in the pot culture conditions. The test crops were randomly collected periodically 15, 30, and they were used for biochemical and mineral content analyses.

Results

Nutritive value of haulm compost

The nutrient contents in haulm compost vary depending on the raw materials that are being used for compost preparation. If the raw materials are heterogeneous one, there will be wide range of nutrients available in the haulm compost. If the raw materials are homogenous one, there will be certain nutrients are available.

Organic carbon (%)	:	11.8
Nitrogen (%)	:	6.32
Phosphorus (%)	:	4.59
Potassium (%)	:	3.58

Sodium (%)	:	0.90
Calcium (%)	:	8.80
Magnesium (%)	:	2.55
Copper (%)	:	0.0055
Iron (%)	:	2.48
Zinc (%)	:	1.13
Soil reaction (pH)	:	7. 8 9
Electrical Conductivity (d sm^{-1})	:	1.36

Table 1.Physico-chemical properties of the filed soil

Type of soil	pH	EC	Organic carbon (%)	Nitrogen (kg ha^{-1})	Phosphorus (kg ha^{-1})	Potassium (kg ha^{-1})	Copper (¤g g^{-1})	Iron (¤g g^{-1})	Manganese (¤g g^{-1})	Zinc (¤g g^{-1})	Calcium (¤g g^{-1})
Sandy loam soil	6.8	0.3	0.61	110	32	103	12.02	32.65	13.32	9.56	2.10

Further work is going on the among the values are calculated with standard deviation, statistical analysis and some biochemical, nutrient content, enzyme activity of plants samples, soil microorganism and soil nutrient analysis (after harvesting) remaining days (60 and 90 DAS) of plant samples.

Health Concerns

Allergies

Some people (0.6% of the United States population) report that they experience mild to severe allergic reactions to peanut exposure; symptoms can range from watery eyes to anaphylactic shock, which can be fatal if untreated. For these individuals, eating a small amount of groundnuts/peanuts can cause a reaction. Because of their widespread use in prepared and packaged foods, the avoidance of groundnuts/peanuts is difficult. Some foods processed in facilities which also handle groundnuts/peanuts may carry warnings on their labels indicating such. A hypothesis of the development of peanut allergy has to do with the way groundnuts/peanuts are processed in North America versus other countries, such as Pakistan and China, where groundnuts/peanuts are widely eaten. According to a 2003 study, roasting groundnuts/peanuts, as more commonly done in North America, causes the major peanut allergen Ara h2 to become a stronger inhibitor of the digestive enzyme trypsin, making it more resistant to digestion. Additionally, this allergen has also been shown to protect Ara h1, another major peanut allergen, from digestion a characteristic further enhanced by roasting.

Another hypothesis, called the hygiene hypothesis, states that a lack of early childhood exposure to infectious agents like germs and parasites could be causing the increase of food allergies. Recent (2008) studies comparing age of peanut introduction in Great Britain with introduction in Israel appear to show that delaying exposure to groundnuts/peanuts can dramatically increase the risk of developing peanut allergies. Results from some animal studies (and limited evidence from human subjects) suggest that the dose of groundnuts/peanuts is an important mediator of peanut sensitization and tolerance; low doses tend to lead to sensitization and higher doses tend to lead to tolerance. Peanut allergy has been associated with the use of skin preparations containing peanut oil among children, but the evidence is not regarded as conclusive. Peanut allergies have also been associated with family history and intake of soy products. Though the allergy can last a lifetime, another 2003 study indicates that 23.3% of children will outgrow a peanut allergy.

Some school districts in the United States have banned groundnuts/peanuts. There are experimental techniques which appear to have desensitized some allergic individuals. The most popular technique, oral immunotherapy, works to create desensitization in those allergic by feeding them small amounts of groundnuts/peanuts until their body becomes desensitized. Some progress is possibly being made in the UK, where researchers at Cambridge are studying the effectiveness of the desensitization technique. Research indicates that refined peanut oil will not cause allergic reactions in most people with peanut allergies. However, crude (unrefined) peanut oils are strongly flavoured, and have been shown to contain protein, which may cause allergic reactions. In a randomized, double-blind crossover study, 60 people with proven peanut allergy were challenged with both crude peanut oil and refined peanut oil. The authors conclude, "Crude peanut oil caused allergic reactions in 10% of allergic subjects studied and should continue to be avoided." They also state, "Refined peanut oil does not seem to pose a risk to most people with peanut allergy." However, they point out that refined peanut oil can still pose a risk to peanut-allergic individuals if oil that has previously been used to cook foods containing groundnuts/peanuts is reused.

Contamination with aflatoxin

Groundnuts/peanuts may be contaminated with the mold Aspergillus flavus which produces a carcinogenic substance called aflatoxin. Lower quality specimens, particularly where mold is evident, are more likely to be contaminated. The United States Department of Agriculture (USDA) tests every truckload of raw groundnuts/peanuts for aflatoxin; any containing aflatoxin levels of more than 15 parts per billion are destroyed. The peanut industry has manufacturing steps in place to ensure all groundnuts/peanuts are inspected for aflatoxin.

Conclusion

Crop residues are the non-economic plant parts that are left in the field after harvest. The harvest refuses include straws, stubble, Stover and haulms of different crops. Crop remains are also from thrashing sheds or that are discarded during processing this includes process wastes like groundnut shell. The greatest potential as a biomass resource appears to be from the field residues of some crop plants in Tamil Nadu. Ninety percent of India's production is processed into peanut oil. Only a nominal amount of hand-picked select-grade groundnuts/peanuts are exported. India prohibits the importation of all oil seeds, including groundnuts/peanuts.

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