Journal of Natural Sciences Research www.iiste.org
ISSN 2224-3186 (Paper) ISSN 2225-0921 (Online)
Vol.5, No.2, 2015

Mulches and Organic Manures as Renewable Energy Sources for Sustainable Farming.

Ibeawuchi, I.I, Iwuanyanwu, U.P; Nze, E. O; Olejeme, O. C,and Ihejirika , G.O
Department of Crop Science and Technology, Federal University of Technology, Owerri
ii_ibeawuchi@yahoo.co.uk

Abstract
The application of organic mulches, organic manures and renewable energy sources on the soil is effective in improving the quality of soil and increasing crop yield especially in organic farming. This paper discussed organic mulches, organic manures and renewable energy sources for sustainable farming in agro-ecosystem. Organic mulches such as bark products, wood chips, deciduous tree leaves, mint compost, saw dust; organic manures such as urine, poultry manure, bat guano, bone meat, fish meal and some renewable wastes such as biomass waste, plant wastes and human wastes have been identified. Besides controlling weeds, erosions, conserving moisture and sustaining soil productivity by improving physical and biological soil conditions and preventing degradation of the soil, they also serve as soil amendment and natural sources for subsequent crops upon mineralization and also help to attract earthworm. The use of organic mulches, organic manures and renewable energy sources is therefore recommended, considering the high cost of inorganic fertilizer, nutrient run- off and a number of health issues that result from agro chemical residue.
Key words: organic mulches, organic manures, renewable energy sources, organic farming, sustainable farming, agro- ecosystem.

INTRODUCTION

With the ever increasing human population and urbanization, the demand for agricultural products has increased with land being of limiting factor. The "traditional" system of shifting cultivation in most developing countries is giving way to continuous system of cropping on the same piece of land, resulting in gradual depletion of soil fertility and crop yield. Harsh climatic conditions have also contributed to the declining soil fertility in the developing countries (Henao and Baanante, 1999).

Inorganic fertilizer are easier to use and we have more control over the content of nutrients in these sources, this allows nutrients to be applied more accurately (Bailey, 2002). Even though inorganic fertilizers add necessary nutrients to the soil; their regular use causes long term depletion of organic matter, soil compaction and degradation of overall soil quality (Sullivan, 2004).

It has been reported that farming on any agricultural land such as Africa, Canada, North America and Europe has basically focused on increasing productivity while reducing labour cost through technological advancement. The use of capital inputs such as fossil fuels, chemical fertilizers and pesticides, patented genetic material and machinery has played a key role in helping farmers achieve their goals, which include increased crop yield (Beekie, 2000a).

Organic farming depends mainly on soil organic matter (O.M) and biological activity as major nutrient supplier in the soil and this, in turn is dependent largely on the incorporation of plant biomass. Organic matter decomposes to release nutrients that are taken up by subsequent crops (Hendrix *et al.,* 1986). The size and composition of the soil microbial biomass can affect the rate of decomposition of organic matter (Parker, 1990).

The benefits of growing annual legumes or legume- cereal intercrops in organic farming are well documented (Fujita eta/., 1992; Fowler eta/., 2004; Cherr et *al,,* 2006).

Legumes and non-legume crops can be grown and incorporated before the soil crops that are tilled back into the soil while they are still green are termed green manure (G.M) crops.

Organic farming is appreciated by vegetable consumers as it enhances quality of the produce. Presently, people are willing to get the vegetable without the inorganic fertilizer because the people are suffering with some diseases which are due to effect of inorganic fertilizer. Most vegetable crops such as lettuce, fluted pumpkin and cucumber need plenty of water for their normal growth and development. Artificial water application or irrigation is imperative for their successful production. Nevertheless, additional irrigation causes increased cost of production. Under this condition, mulching may be practiced in which can be a substitute of irrigation to minimize cost of production (Asaduzzaman *etal.,* 2010).

Mulching is also highly effective in checking evaporation and is hence recommended for most crops of home garden like potatoes, sweet potatoes, carrot, fluted pumpkin, pumpkin tomatoes and ginger (Kim et *al.,* 1988; Jaiswal et *al.,* (1996). Mulching also suppresses weed infestation effectively.

Biomass comprises mainly trees and plant wastes (e.g. wood, saw dust, leaves, twigs agricultural residues, animal and human waste, coal etc. These wastes, of plant, animal and human origin are the resources that yield valuable energy and fertilizer. Bio residues, dung from animals, different types of crop residues such as rice, straw, wheat straw, maize stalk, leguminous plants and weeds, aquatic plants are already widely used in some countries would be to treat the bio degradable waste into an anaerobic digester in view of the producing environmentally sound energy as well as bio-fertilizer (Karki, 1998).

It is against this background that this paper aims at discussing mulches organic manure and renewable energy sources for sustainable farming in agro-ecosystem. Many scientists at different levels have elaborated the concept of organic farming; the important descriptions are as follows:

Lampkin (1990) defined organic farming as a production system which avoids or largely excludes the use of synthetically compounded fertilizers, growth regulators and live stock feed addition. To a great extent, feasible organic farming systems depend on crop rotation, crop residues, animal manures, legumes, green manures, off farm organic water and aspects of biological pest control to maintain soil productivity and tilth to supply plant nutrients and to control insect pests, diseases and weeds.

US Department of Agriculture defined organic farming as, "A system that is designed and mailed to produce agricultural products by the use of methods, and substances that maintain the integrity of organic agricultural products until they reach the consumer.

According to Funtilana (1990) "Organic farming is giving back to the nature what is taken from it". It is not mere non-chemicalism in agriculture; it is a system of farming based on integral relationship. Therefore, one should know the relationship among soil, water, plant and micro flora and over all relationship between plants and animal kingdom. It is the totality of these relationships, which is the backbone of organic farming.

Above all, the success of organic farm is dependent upon a great extent the efficiency of agronomic management adopted to stimulate and augment the underlying productivity of the soil resources. All the management practices followed in organic farming and governed by the principles of ecology and are within the ecological means.

The basic concepts behind organic farming are:

* It concentrates on building up the biological fertility of the soil so that the crops take nutrients they need from the steady turnover within the soil nutrient produced in these way are released in harmony with the needs or plant.
* Control of pests, diseases and weeds is achieved largely by the development of an ecological balance within the system and by use of bio-pesticides and various cultural techniques such as crop rotation, mixed cropping, and cultivation.
* Organic farmers recycle all waters and manure within a farm but the export of the products from the farm results in a steady drain of nutrients.
* In a situation where conservation of energy and resources is considered to be important, community or country would make every effort to recycles to all urban and industrial wastes back to agriculture and thus the system would only be a small inputs of new resources to "top up" soil fertility (Maity and Tripathy, 2006).

Main characteristics of organic farming include:

Protecting the long -term fertility of soils by maintaining organic matter levels, soil biological activity and careful mechanical intervention, .

Nitrogen self-sufficiency through the use of legumes and biological nitrogen fixation as well as effective recycling or organic materials, including crop residues and livestock wastes. Weed, disease and pests control relying primarily on crop rotation, natural predators, crop diversity, organic manure, use of resistant varieties and limited thermal, biological and chemical intervention.

Supplementing crop nutrients, where necessary, by using nutrient sources which are made available to the plants indirectly but the action of soil micro organisms and chemical reactions of the soil. The extensive management of livestock paying full regards to their evolutionary adoptions behavioural needs and animal welfare issues with respect to nutrition, hours, health, breading and rearing.

Careful attention to the impact of the farming system on the wider environment and the conservation of wide life and the conservation of wide life and natural habitat (Padel and Lampkin, 1994). is spread over the soil surface and influences soil characteristics and sometimes plant growth.

Organic mulches accumulate naturally in forests, in gardens where leaves and organic debris are not removed, and in lawns that are "mulch mowed". The most common organic mulches used in include bark

products, yard waste compost, wood chips (arborist mulch) mint hay, deciduous tree mulch grass mulch (Bell, *et al.,* 2009).

Benefits of Mulch

Mulch has many positive effects on soils. Generally, organic mulches conserve water, reduce weeds, improve soil quality and enhance plant growth.

Weed Conserve Moisture

Mulch reduces irrigation need by reducing surface evaporation and run off. Mulches also protect the soil from compaction by rain and foot traffic. By preventing the loss of soil structure caused by compaction, mulches promote water infiltration into the soil. Also mulched plants can better use water stored in the soil because they have larger root systems than mulched plants.

Controlling Weeds

What is mulch?

Mulches can be used both to control existing weeds and to prevent weeds from sprouting. A mulched layer excludes light. Without higher sunlight, young weeds cannot produce sugars needed for growth and ultimately die. Some weed seeds require light in order to germinate, so mulch can also prevent germination. Finally, small seeded weeds generally can not emerge through a 3-inch mulch layer.

Promoting soil fertility and health:

Decomposition of weed chips, bark dust and saw dust can compete for Nitrogen (N) with some plants. These mulches are high in carbon (C) and very low in nitrogen. In other words, they have a high C: N ratio mulches are decomposed basically by microbes (bacteria and fungi) in the soil or at the soil surface. These microbes need N to survive. When decomposing a woody mulch with a high C:N ratio, microbes compete with plants for N available in the soil.

Mulches attract earthworms. Like human, however, earthworms have food preferences. They tend to avoid very woody mulches; such as bark mulch or wood chips, untii the mulch breaks down some what they readily feed on leaf mulch.

Organic mulches when added increases the soil water content, which stimulates microbiai activity. Also, reducing the need for tillage to control weeds preserves soil microbes. Organic mulches also increase surface rooting by improving oxygen and moisture conditions at the mulch soil surface.

Weeds remain one of the most significant agronomic problems, especially on organic farms, because weed control can only be carried out without herbicides. This is a strong interest in developing alternative methods of weed control in organic agriculture (Economou *et al.,* 2002). Mulching as a weed control method is used in agriculture throughout the world (Gupta, 1991). Organic mulches are more popular in cropping system, as they can suppress weeds, while at the same time reducing soil tillage for weed control, under any tillage system implemented (Bilalis *et a!.,* 2003). It has been shown that residues of small grains inhabit weed emergence and growth in cropping systems by allelopathy (Putman, et al, 1983, Blum, et *a/.,* 1997). Since weed seed germination is affected by soil moisture and temperature, mulch not only suppresses weeds, but also maintains soil moisture at higher levels compared with unmulched soils (Sharma and Achraya, 2000; Edwards et a/., 2000).

Mulches improve plant growth:

Mulched plants often grow better than unmulched plants. This difference may be due to higher soil moisture level enhanced soil fertility and reduced weed competition. Crops and young trees planted in the farms and lawns respectively establish and grow faster with a mulched space around the trunk. In this case enhanced growth is due to reduced root competition firm turf and to higher nitrogen levels.

Pest and Disease Management

Generally, appropriate mulching increases plant health and resistance to diseases and insect pests. Repeated addition of organic matter slowly increases the organic matter content of the soil. The resulting increase in biological actively and biodiversity in the soil helps suppress plant disease organisms.

Mulched plants are also insulated from environmental stresses such as drought or extreme cold or heat. Excessive mulch materials, nevertheless, can result in wet root zones and increased root rot diseases.

Sources of Mulches for sustainable agro-ecosystem Bark Products

Bark here is referred to as bark dust. The most common bark products are Douglas fir and hemlock. These products are sold in bulk or in bags, sometimes with colouring added for decorative purposes.

Bark products typically have a PH around 4 and a high C: N ratio. Bark also contains a high proportion of lignin a plant constituent that is highly resistant to decomposition. Bark contains very low level value as fertilizer (Bell *etal.,* 2009).

Wood Chips

Wood chips are made from the heart-wood of a tree, as opposed to its bark. They may be manufactural from Douglas fir, western red cedar or hard woods such as alder. Wood chip have a very light colour but turn gray as they age. Wood chips are often used to line pathways or as a ground cover in play areas, but they are often used as mulch.

Wood chips generally decompose faster than bark nuggets of similar size. Like bark dust, wood chips have low C:N ratio and very low levels of available plant nutrients. They are very good in controlling weeds like the bark nuggets.

Yard Waste

Yard wastes are sometimes sold as "garden compost" (or yard debris) compost. It comprises processed grass chippings, leaves, brush and trees and shrub burnings. After composting for between 3 and 9 months in large piles, it is sorted to remove large sticks. After that they are bagged and usually contain fewer coarse particles (those larger their Vz inch) than bulk mulch.

During the process of composting, piles usually reach temperature above 130 of killing most weed; with P^H of 6 to 7 and a C:N ratio of 20:1. Yard waste compost has an attractive colour and fine texture. It is not very effective at controlling weeds.

Arborist Mulch

This product consists of chopped limbs and trunk of trees that have been pruned or removed. It consists of wood, bark and leaves from one or more trees or shrub species. Arborist mulch is very coarse and may contain some sticks and large pieces, so it is not form in appearance as bark mulch. The P^H of arborist much is low and it is low in most nutrients. Arborist mulch has allelopathic effect but this has not been any documented evidence that it harms woody plants.

Deciduous Tree Leaves

Leaves are a readily available organic matter source. Partially decomposed leaves are known as leaf mulch or leaf mold. The product has a near neutral PH (6 to 7.5). The C: N ratio typically is about 50:1 in fresh leaves, decreasing to below 20:1 when leaves are fully composed. Most of the leaves are good sources of potassium.

Mint Compost

Peppermint hay consisting of leaves and stems that have been heated to remove peppermint oil. It is one of the most commonly available residues from Willamette Valley farms mint compost is useful in informal settings, but it decomposes rapidly and does not provide effective long term weed control.

Saw Dust

Saw dust is a by-product of lumber processing and may also be available from cabinet makers and mills that make moldings. Like wood chips, sawdust is made from heart wood, not bark, but the particles all much smaller. Sawdust is occasionally available in bulk.

The fine texture of sawdust can allow it to crust over and repel water, reducing water infiltration. It is recommended that sawdust should not be used on slope or where water might flow over the soil surface.

Although the initial high C:IM ratio of sawdust provides reasonable weed control, the small particles size brings about rapid decomposition. Re-application usually is required much sooner with sawdust than with wood chip mulch. Table 1 consists of characteristics of mulches**.**

Table 1: Characteristics of Mulches

	Water Conservation	Ease of application	Weed control	Nutrient release	Erosion control	Longevity	Cost
Bark dust (medium	**		***	*	**	**	*
Bark nuggets	***						
Wood chips	**	***	*	**	***	**	**
Yard waste compost	**		***	*	**	**	**
Arborist mulch	**						
Tree leaves	**	*	***	**	*	*	*
Mint compost	***	***	*	***	**	*	*
Sawdust	**	**	**	**	*	*	*
Hazelnut	***	*	**	***	*	*	*
	**	**	*	**	**	*	***
**	***	*	**	***	***	***	

= low; ** = medium;*** = high

Source: Bell, et al. (2009).

Organic Manure

Organic manure covers manures made from cattle dung, excreta of other animals rural and urban composts other animal wastes, crop residues and green manures. Organic manure is time tested materials for improving fertility and productivity of soils. Almost all kinds of organic matter may be used as manures, but some kinds are better than others. Organic manures vary widely in the growth of plant nutrients that they contain. Some are more concentrated than others.

Compost is one of the less concentrated organic manures but it is extremely valuable in adding extra body to soils especially in sandy soils, compost can also help to lighten heavy clay soils.

Simple chemical substances are taken up by plant roots in dilute solution. Organic substances are complex and insoluble and must be broken down or decomposed before they may be taken up by a plants roots.

Consequently, organic manures which break down or decay quickly are available to the plant faster than those which decay slowly. The rate of decay is a function of temperature. The higher the temperature, the more quickly the nutrient, in the manure will become available to the plant. At the same time, the quicker that the nutrients become available to the plant the more rapidly those nutrients will be depleted. In practice, too much organic manure applied at once will decompose before the plant may make use of it. So smaller applications of manure applied frequently are more beneficial to the plant than larger application applied less frequently.

Sources of Organic Manure for sustainable agro-ecosystem.

Cow, Horse or sheep manure are the most common organic manure available. Elephant manure (when the circus is in town) may be used in the same way as cow; horse and Sheep manure. These manures may be used by mixing with soil or by adding then to compost. When fresh, they may be mixed with

water and this resulting manure will be applied to the soil around the plant. These manures when dried may also be mixed with potting soil, because these manures do not contain a proportion of plant food.

Urine - Yes pee. Whether from man or animal, it is extremely valuable manure as it contains higher proportion of nitrogen than cow, horse, Sheep or Elephant manure. Urine should not be used fresh but kept for a few days and then diluted at a ratio of 1 to 4 with water. It may then be applied directly to the ground around plants. Urine is also useful as a source of added nitrogen to compost. It should be noted that urine should be kept in a closed container out of the house, prior to use as it will definitely become stinky.

Poultry Manure: This is available from chicken, duck, geese, turkeys pigeons, parrots and so on. Poultry manure may be used fresh when mixed with soil or as a poultry manure after being rotted for a short time in water. Poultry manure has more concentration then the cattle manures mentioned above as its high in nitrogen. Poultry manure should be stored in a closed container as it is foul-smelling.

Bat Guano: This comes from caves inhabited by bats. It is some what of a boutique fertilizer and tends to be rather expensive for small amounts. Bat Guano is usually higher in phosphorus that nitrogen and may be used in the same way as cattle manure

Bone meal -This organic fertilizer is made from the bones of animals which have been used as food. It contains nitrogen but is valued more for its phosphorus and calcium content.

Blood Meal: This is concentrated organic manure. It is high in nitrogen and must be kept in an airtight container as it is hygroscopic (attracts water). When this happens some of in nitrogen value is lost,

Fish Meal or Fish Emulsion: This is a good fertilizer, but tends to be extremely fishy smelling, Nevertheless, it is a good source of nitrogen and some phosphorus.

Seaweed Of Renewable Waste

Biomass comprises mainly trees and plant wastes (e.g. wood, sawdust, leaves at wigs) agricultural residues, animal and human waste, coal etc. These wastes of plant, animal and human origin are the resources that yield valuable energy and fertilizer. Bio-residues dung from animals, different types of crop residues such as rice straw, wheat straw, maize stalk, leguminous plants and weeds, aquatic plants are already widely used in some countries One of the best options would be to treat the bio degradable waste into an anaerobic digester in view of the producing environmentally small energy as well as bio-fertilized (Kharki, 1998).

It is estimated that 60 percent of the world's population live in rural areas of the developing countries and rely on agriculture for their well hood. About one billion people rely on residue as their principal cooking fuel. In many areas, particularly in Asia, the commercialization of bus residue is a source of modest income but at the same time it is a burden for poor people. Very often the visualization of Bio-residue is associated with a very low efficiency and therefore a higher level of smoke emission and a negative impact to health.

Organic residues or broadly speaking "biomass" comprise

i -

materials of plant animal and human origin. The wastes produced from these organic materials are the resources which can profitably be used to generate valuable energy and fertilizer. Bio residues dung from animals and different hypes of crop residue (are already unduly used in some countries and there is still a great potential to be tapped.

Biomass Waste

Biomass exists in the thin surface layer of the earth. It represents only a thin fraction of the total mass of the earth but it is an enormous store of energy. The store is being replenished continuously. Sun is the resource supplying energy. In fact, very small fraction i.e. about 0.5 percent of thfe solar energy striking the earth is believed to be captained by plants' through photosynthesis on world bases, Biomass includes mainly trees and plant wastes e.g. crop, sawdust, leaves, twigs agricultural residues animal wastes coal etc (Kharki and Dixit, 1984)

Plant Wastes

Any biodegradable material whether plants or animal origin can be used for production of renewable energy. Plant materials such as crop residues, weeds aquatic plants etc are also the source for methane production. Gas production is better if these materials are mixed with animal or human waste. *Eichhornia crassipes* (water hyacinth) is considered to be an obnoxious weed. This aquatic weed which has almost the same C/N ratio as that of cow dung (i.e. 24) has provein. To be an excellent plant material for making production similarly *Eupatotruum adenophorum* (Banmara) in Nepal of another weed which has been very devastating with forest and pastoral land in Nepal (Kharki, 1998). .

Animal waste

Animal wastes are excellent raw material for methane generate in the developing countries where biogas technology to advanced, it is customary to use cattle and buffalo dung to feed the digester. A homogenous mixture can be made while mixing the dung with water (Slurry) facilitating the digestion process. Chicken or poultry manure is also a good source for biogas production. Raw material from other animals include goat and sheep manure horse, and elephant dung etc. it should be noted that while mixing with water, goat and sheep manure has the tendency of floating whereas horse and elephant dung contain fibrous material.

Human Waste

Compared to animal waste, human feaces and latrine for waste have been used for methane generation in limited scale in most of the developing countries due to social or religious reservation. The only exception is China where latrine is in traditionally and socially acceptable and is used to produce biogas for cooking and lighting and bio manure to enhance soil fertility. In recent years, the acceptability of latrine waste is increasing in Nepal as about 40 percent of the installed biogas plants are found attached to latrine.

Human feaces contain pathogens and has offensive odour. If not treated properly it can cause disease and can be detrimental to human health. Therefore one of the best ways to dispose human waste is to treat it in anaerobic digester producing biogas as energy and affluent and fertilizer.

Conclusion and Recommendations

Organic mulches, organic manure and renewable energy sources are effective in improving the quality of soil and increase the crop yield. Organic manures have been identified to be of great economic value in food crop production. This varies from increased crop growth and yield of food crops when used in combination with organic mulches and renewable energy sources.

In as much as organic products are bulky, they are definitely more sustainable in the long run and they help in improving soil fertility, weed control and erosion control.

The use of organic mulches, organic manure and renewable energy is therefore recommended for sustainable farming in agro-ecosystem, considering the high cost of inorganic fertilizers and health issues resulting from agro-chemical residues.

Finally, in order to ensure sustainable use of these organic mulches, organic manure and renewable energy sources and considering their numerous advantages, researchers should be encouraged to determine the nutrient composition of each organic manure and renewable energy sources and ensuring that the mulches do not harbour obnoxious weed seeds, thus removing nutrient imbalances which has the same harmful effect like the abuse of the use of inorganic fertilizer.

REFERENCES

Asaduzzaman, M.D., Sultana, S. and Arfan, A. (2010).
Combined Effect of Manure on the Growth and yield of Lettuce. American - Eurasian. J. *of-Agric. & Environmental Science 9 (5) 504 - 508 2010. ISSN 1818-6769 (C) IDOSI Publication, 2010. '*

Bailey, K. (2002). Fertilizer zone N.C State University,
CooperativeExtension *,http//ces state, neus/cumberland/fertpage/fert basics html.*

Beekie, M. A. (2000a). Zero tillage and Saskatchewan. An
Inter-disciplinary study of the development of sustainable agriculture. PhD.diss.Univ.of Saskatchewan, Saskatoon, Canada.

Bell, N., Sullivan, D.M., and CookT., (2009). Mulching wood
Ornamentals with organic materials. Oregon State University. Extension Service. E.C 1629 E. pp 1 - 10-

Bilalis, D., Sidiras, N., Economou, G and Vikali, C. (2003).
Effect of different levels of wheat straw, soil surface coverage on weed flora in *Vie/a faba* crops. *Agron. crop ScL 189, 233-241.*

Blum, U. L, King, T., Gerig, M., Lehman, M. and Woshen, A.D. (1997).
Effects of clover and small grain cover crops
and tillage techniques on seedling emergence of some dicotyledonous weed species. *American J. Alter. Agric.* ***12,*** *146-161.*

Cherr, C.M., J.M.S. Scholberg and R.Mcsorley, (2006).Green
manure approaches to crop production: A synthesis. *Agron. J. 98: 302 -319*

Danja Jodagiene, Rita Pupaliene, Ausra Sinkericiene; Ausra Marcinkeviciene, Kritina Zebrauskaite, Miida Baitaduonyte, Rita cepuliene. The influence of organic mulches on soil biological properties. *ISSN 1392 - 3196.* Zemdirbyste - Agriculture Vol. **97,** No. 2 (2010), P. 33-40) UDK 631, 874, 4: 631, 465: 631. 468. 514 339

Ezonomou, G.O., Tzakuo, A., Gani, A., Yannitsaros, A. and Bilalis, D. (2003). *Allelopathic effect of Conyza albida on Avena Sativa and Spirodela polyrhei. J, Agron. Crop Science 188.248-253*

Edwards, L., Burney, J.R., Richter G. and Mac Rae, H.H., (2000). Evaluation of compost and straw mulch on soil - loss characteristics in erosion plots of potatoes in Prince Edward Island, Canada Agriculture, Ecosystems and Environment 81; 217 - 227.

Fowler, CJ. E., L.M., Condron, and K.D Me Lenaghen. (2004). Effects of green manure on nitrogen loss, and availability in an organic cropping system N.Z. T. Agric. Res. 47:95 - 100.

Funtilana, S. (1990). Safe, inexpensive, profitable and sensible. *International Agricultural Development, March-April 24.*

Fiyita K., K.G Ofosu-Budu and S.Ogata (1992). Biological nitrogen fixation in mixed-legume cereal cropping system. Plant soil. 141: 155-175.

Gupta, G.N. (1991). Effects of Mulching and fertilizer applications on initial development of some tree species. *For Ecol. Management 44, 211-221.* Henao, J. and Baanante, (1999) *Nutrient depletion in agricultural soils of'Africa. 2020 vision Brief 62. Washington, D.C IFPRI.*

Hendrix, P.F., R.W. Parmelee., D.AJ. Crossley., D.C. Coleman, (1986). Detritus food webs in conventional and no tillage agro ecosystems. *Blosci 36.374* - 380.

Jaswal, J.P., P.P. Subedi and H.M. Gurung (1996). Fertilizer trial in carrot connected at outreach research sites for off-season production working paper. *Lumle Res Centre, Kaksi, Nepal **24:** 96:103.*

Jodaugiene., R. Pupaliene, M. Urboniene., V. Prankietis and I. Prankietiene. (2006). The impact of different types of organic mulches on weed emergence. *Agronomy Research 4 (special issue), 197-201, 2006.*

Kharki, A.B and Dixit, K. (1994). Biogas Field Book Sahayogi Press P.V.T. Ltd. Tripureshwar, Kathmandu, Nepal.

Kharki A.B and Guatain K.M (1994) Biogas installation from Elephant dung at Mecham Wild Life Resort, Chitwan Nepal Biogas Newsletter issue No. 45.

Kharki, A.B. (1998). Consolidated Management Services, Nepal (P) Ltd Kathmandu, Nepal.

Kharki, A.B and Gautam, K.M. (1998) C.M.S preliminary proposal on Kathmandu valley Municipal solid waste utilization pilot project consolidated management services Nepal (P) Ltd.

Kim, S.Y., O.H. Ryu and B.H. Rahman, (1988). The effects of transparent polythene film mulch on the soil temperature potato growth and yield of the spring crop. *Reports of Rural Development Administration Horticulture. Korea Republic, 30:292 - 298. [Cited from field crop Abst 42 (10): 8125 -1989].*

Lampkin, N.H. (1990). Estimating the impact of widespread conversion to organic farming on land use and physical output in the United Kingdom. In Economics of organic Farming (Eds. Lampkin, N.H. and Padel, S.), CAB, walling ford.

Maity T.K and P. Tripathy (2006) organic farming of vegetables in India: Problems and Prospects. Department of vegetable crops, facility of Horticulture. Bidhan Chandra Krishi Viswavidyalaya.

Nehrling,D. (2008). Manures and Soil Amendments. *Internet paper accessed 13/09/09*

Nwaiwu, I.U., Ohajianya D.Q., Lemche, J.I., Ibekwe, U.C., Nwosu P.O., N.C. Ben - chendo., Henri-Ukoha, A. and Kadiri, F.A. (2010). Economics of organic manure use by food crop farmers in ecologically vulnerable Area of Imo State Nigeria. Researcher 2010.2 (1 IT http://www.sciencepub.net/researcher.

Padel, S. and Lampkin, N.H. (1994). Farm-Level performance of organic farming systems: An over view. In Economics of Organic Farming (Eds.) Lampkin, N.H. and Padel, S.) CAB, Wallingford, U. K. pp 201-219.

Parker, C. F. (1990). Role of Animals in sustainable Agriculture, P. 238 - 245. In sustainable Agricultural System (C.A Edwards R. Lai. P. Maddeny R.H Miller and G. House, eds.). Soil water cons. Soc., Ankeny, T.W.

Putman, A.R; DeFrank, J. and Barnes, J.P. (1983). Exploitation of allelopathy for weed control in animal and perennial cropping systems. J. chemistry Ecology. 9,1001-1010.

Sullivan, P. (2004) "Sustainable soil management: soil system Guide. ATTRA. Natural Sustainable Agriculture Information Service. National center for Appropriate Technology (NCAT). May 2004, http://attra.neatorg/altra-pub/PDF/soilmgm t. pdf.

The IISTE is a pioneer in the Open-Access hosting service and academic event management. The aim of the firm is Accelerating Global Knowledge Sharing.

More information about the firm can be found on the homepage:
http://www.iiste.org

CALL FOR JOURNAL PAPERS

There are more than 30 peer-reviewed academic journals hosted under the hosting platform.

Prospective authors of journals can find the submission instruction on the following page: http://www.iiste.org/journals/ All the journals articles are available online to the readers all over the world without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself. Paper version of the journals is also available upon request of readers and authors.

MORE RESOURCES

Book publication information: http://www.iiste.org/book/

Academic conference: http://www.iiste.org/conference/upcoming-conferences-call-for-paper/

IISTE Knowledge Sharing Partners

EBSCO, Index Copernicus, Ulrich's Periodicals Directory, JournalTOCS, PKP Open Archives Harvester, Bielefeld Academic Search Engine, Elektronische Zeitschriftenbibliothek EZB, Open J-Gate, OCLC WorldCat, Universe Digtial Library , NewJour, Google Scholar