Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; 7(2): 3296-3301
Received: 22-01-2018
Accepted: 23-02-2018

C Subha Lakshmi
Department of Agronomy, College of Agriculture, Rajendranagar, Hyderabad, Telangana, India

Ch Chandra Sekhar
Department of Soil Science & Agricultural Chemistry, ICAR-CRIDA, Santhoshnagar, Hyderabad, Telangana, India

Correspondence
C Subha Lakshmi
Department of Agronomy, College of Agriculture, Rajendranagar, Hyderabad, Telangana, India

Importance of medicinal and aromatic plants and their response to organic sources: A review

C Subha Lakshmi and Ch Chandra Sekhar

Abstract
In recent years, the demand for medicinal and aromatic plants has grown rapidly because of accelerated local, national and international interests, the latter notably from the pharmaceutical industry. Effective nutrient management plays a major role in accomplishing the increase in production. Organic sources of nutrients not only help in supplementing the nutrients but also maintain favourable physical, chemical and biological soil environment. Organically grown products also command high prices in the market. This review presents the importance of few medicinal and aromatic plants viz., *Aloe vera*, Ashwagandha, Ginger, Turmeric, Ocimum, Lemon grass and Mint and their response to the application of organic sources.

Keywords: organic sources, *Aloe vera*, ashwagandha, ginger, turmeric, ocimum, lemon grass, mint

Introduction
Medicinal and aromatic plants are economically important plants which provide basic raw materials for medicines, cosmetics, flavours and perfumes. These plants and their products not only serve as valuable source of income for small holders and enterpreneurs but also help the country to earn foreign exchange by way of export. Medicinal plants are those plants which are rich in secondary metabolites and are potential source of drugs. These secondary metabolites include alkaloids, glycosides, flavonoids, sterols etc. Aromatic plants possess odourous volatile substances which occur as essential oil, gum exudate, balsam and oleoresin in one or more parts namely, root, wood, bark, stem, foliage, flower and fruit. Medicinal and aromatic plant products grown organically are not only readily accepted in the global market but also fetch high prices compared to the products cultivated using synthetic fertilizers. Studies conducted revealed that the application of organic nutrient sources increased the biomass yield and also the quality parameters in medicinal and aromatic plants. As the medicinal and aromatic plants form a numerically large group of plants, review related to few plants have been collected and presented hereunder:

1. *Aloe vera* (*Aloe barbadensis*)
Aloe vera is a popular medicinal plant. It belongs to Lilliaceae family. Its leaves are long, thick and juicy with a wheel like phyllotaxy. There are more than 200 compounds found in *Aloe barabadensis*, about 75 of which have biological activity. *Aloe vera* leaves contain a diverse array of compounds including anthraquinones (aloe-emodin), anthrones and their glycosides (eg. 10-(1, 5'anhydroglucosyl)-aloeemodin-9-anthrone, also known as aloin A and B), chromones, carbohydrates, proteins, glycoproteins, aminoacids, organic acids, lipids, sugars, vitamins and minerals (Roy Upton *et al*., 2012; Saeed *et al*., 2004; Patidar *et al*., 2012) [1-3]. *Aloe vera* has many uses and mainly it is used as food preservative and medicine. Commercially, Aloe can be found in pills, sprays, ointments, lotions, liquids, drinks, jellies and creams. Pharmacologically it is an immunity booster and detoxifies the system. It is recommended in adjuvant therapy with antibiotics, NSAIDs (Non-steroidal Anti-inflammatory drugs) and chemotherapy to eliminate drug induced gastritis and other adverse effects. It is useful in various diseases such as type II diabetes, arthritis, eye disease, tumour, spleen enlargement, liver complaints, vomiting, bronchitis, asthma, jaundice and ulcers. It also relieves constipation and maintains a good gastric pH, helps in inflammatory bowel diseases, non-ulcer dyspepsia, gastric and duodenal ulcers. It is used as a dietary supplement for pre and post-operative patients, post-menopausal women and in cases of osteoporosis (Rajeshwari *et al*., 2012) [4]. Due to multiple uses *Aloe vera* provides, its demand has been increasing day by day. Fertility management in the field may be one of the strategies for boosting up the yield of *Aloe vera*. As *Aloe vera* is a succulent plant it is more responsive to nutrients.

However excess doses of chemical nutrients as well as improper sources can show negative effect on quality of *Aloe vera*. Organic manures are more effective in increasing *Aloe vera* plant growth and yield and it also enhances leaf quality. Results of few experiments conducted to evaluate the effect of various organic sources in *Aloe vera* are presented: An experiment was conducted by Saha *et al*. (2005) [5] to study the effects of organic and inorganic sources of fertilizer on performance of *Aloe vera* in Science and Technology Entrepreneur Park, Indian Institute of Technology, Kharagpur, India. The soluble fertilizers were supplied using fertigation. The organic source of fertilizer was liquid vermiwash, while inorganic N and K fertilizers were urea and murate of potash in solution form. The results revealed that there was significant increase in biological and gel yields, plant height, number of leaves per plant and chlorophyll content with application of fertilizer as compared to no fertilizer treatment. Organic source of fertilizer in the form of vermicompost and vermiwash was found to be effective and comparable with inorganic source of fertilizer in increasing content of gel moisture, gel ash and aloin. The organic *Aloe vera* thus produced is expected to be a better marketable product. Krishna Moorthy and Malliga (2012) [6] from Bharathidasan University conducted a pot culture experiment to evaluate the effect of different rates of cyanopith biofertilizer (25g, 50g, 75g, 100g, 125g and 150g) on the morphological and biochemical characteristics as well as yield of *Aloe barabadensis* Miller. Plants grown without any treatment was regarded as control. Maximum plant height, number of leaves, leaf weight, leaf breadth and no. of offsets was recorded with the application of 100g cyanopith biofertilizer. Significant improvement in gel and latex yield as well as chlorophyll a, chlorophyll b, total chlorophyll, carotenoids, free amino acid and sugar contents was also observed with 100g cyanopith biofertilizer revealing that 100g of cyanopith was the optimum concentration for maximum improvement of the plant characteristics and yield of *A. barbadensis* Miller. Another pot experiment was conducted by Hasanuzzaman *et al*. (2008) [7] at Sher-e-Bangla Agricultural University, Dhaka, Bangladesh to evaluate the effect of different amount of manures on the leaf, plant characteristics and yield of *Aloe vera.* There were 8 different treatments comprising 100% soil (control), 50% cowdung + 50% soil, 25% cowdung + 75% soil, 10% cowdung + 90% soil + urea, 10% cowdung + 90% soil, 5% cowdung + 95% soil + urea, 5% cowdung + 95% soil, soil + urea. It was observed that the plant produced highest number of leaves and maximum leaf weight, maximum leaf breadth and total leaf area with application of 50% cowdung + 50% soil. Tiller weight, stem weight, and root weight as well as root length was also found to be highest with 50% cowdung + 50% soil treatment. The growth rate of leaves was also significantly affected by different manure treatments where maximum effect was noticed at early stages with all the treatment. It was revealed that urea had a little effect on plant character of *Aloe vera* over organic manure (cowdung). In a trial conducted by Rajendran and Gnanvel (2008) [8] the highest leaf yield of *Aloe vera* was obtained with the application of neem cake @ 1.5 t/ha. The root length, shoot length and number of root branches and stem branches were highest when the aloe plants were grown in vermicompost and FYM pretreated soil (Guleria *et al*., 2013) [9]. The application of pigeon manure resulted in maximum number of leaves, fresh weight, leaf diameter and chlorophyll index of *Aloe vera* (Hoseini *et al*., 2013) [10].

2. Ashwagandha (***Withania somnifera***)

Ashwagandha belongs to family Solanaceae. It is known as 'Indian Ginseng' because of similarity between the properties of Ashwagandha roots and restorative properties of ginseng roots. Ashwagandha is a well-known herb possessing several health benefits which improves immune system, helps in lowering cholesterol, helps in regulating blood sugar level, stimulates collagen and promotes wound healing, reduces depression, stress and increases muscle mass. It improves learning ability and memory. The traditional use of Ashwagandha was to increase energy, youthful vigour, endurance, strength, health, increase vital fluids, musle fat, blood, lymph, and semen and cell production. The total alkaloid content in the roots of Indian types has been reported to vary between 0.13 and 0.31%. A total of 13 components have been obtained chromatographically. This includes choline, tropanol, pseudotropanol, cuscopygrene, 3-tigloyloxytropana, isopellatierine, anaferine, anahygrine, withasomnine and several other steroidal lactones. In addition to the alkaloids, the roots are reported to contain starch, reducing sugars, hentriacontane, glycosides, dulcitol and withancil. In addition the leaves are reported to contain withanolides, glycosides, glucose and many free amino acids. The occurrence of chlorogenic acid, condensed tannin and flavonoid are also reported (Anonymous, 2004) [11]. The roots of Aswagandha and occasionally its leaves and seeds are used in Ayurvedic and Unani systems of medicine. The pharmacological activity of the roots is attributed to the presence of several alkaloids and withanolides which is affected by nutritional status of soil (Maheshwari *et al*., 2000) [12]. The yield and quality of any crop heavily relies on the nutrient supply. The result of trials conducted with organic sources solely and in integration with inorganic sources in Ashwagandha is presented: The yield and quality contributing characters like root diameter, root length and alkaloid content of roots were higher in plants treated with poultry manure in Ashwagandha (Mohanalakshmi and Vadivel, 2009) [13]. In a field trial conducted by Shimrayngayung (2008) [14] it was observed that the application of castor cake @ 6 t/ha + 50% RDF (20:30:10 :: N:P:K) + phosphorus solubilizing bacteria (PSB) @ 2 kg/ha + Azospirillum @ 2 kg/ha recorded the highest plant height, leaf area/plant, leaf fresh weight/plant, dry weight of leaf/plant, fresh shoot weight, shoot dry weight, root length, fresh and dry weight of roots. Guruprasad *et al*. (2014) [15] reported that the highest individual root length and diameter, fresh root yield and dry root yield were obtained where the plants were raised with FYM @ 5 t/ha + vermicompost @ 0.5 t/ha. The results of another trial conducted by Ashashri Shinde *et al*. (2013) [16] revealed that the application of vermicompost @ 1.3 kg/ha significantly increased the number of leaves, leaf length, number of branches, root length and diameter, fresh weight of roots, dry weight of roots and seed weight.

3. Ginger ***(Zingiber officinale)***

Ginger is a perennial herb with robust branched rhizome borne horizontally near surface soil. It belongs to family Zingiberaceae. There are 3 primary products of the ginger rhizomes, namely fresh, preserved and dried ginger. Fresh or green ginger is consumed as a vegetable. Immature ginger preserved in sugar syrup is mainly used as a desert. The dried rhizomes constitute the spice and esteemed for its flavour, pungency and aroma. It is a constituent of curry powder. It is also used in the production of ginger beer, ginger oil and ginger wine. The rhizome yields an essential oil, but this lacks

the pungent principle. It is used in the manufacturing of essences and in perfumery. An oleoresin is also extracted in which the full pungency of the spice is preserved. It is used for flavouring purposes and in medicines. Taken internally it is a stimulating carminative and externally is used as a rubefacient and counter irritant. Studies on health related effects of ginger which have also stimulated farmers' concern on the growth of the plant have shown the efficacy of the plant in some life challenging ailments such as entero toxin induced diarrhoea, diabetic nephropathy, nausea, plasma antioxidant, vomiting, high cholesterol, high blood pressure and inflammation (Chen *et al*., 2007 [17]; Ernest and Pittler, 2008 [18]; Kim *et al*., 2008 [19]). Ginger is needed in large quantities both for domestic industries and export. Among the various agronomic technologies influencing the production of ginger, nutrition is found to exert a great influence on growth and yield of ginger. The results of few trials conducted with organic sources in ginger are presented: Results of a field trial conducted by Shaikh *et al*. (2010) [20] at College Farm, College of Agriculture, Pune revealed that RDF + FYM @ 25 t/ha favourably influenced the yield and uptake of nutrients by ginger followed by 50% N through RDF + 50% N through poultry manure. Egbuchua and Enujeke (2013) [21] from Nigeria reported that organic manures in the form of cow dung, poultry and pig manures have great tendency to increase growth characters and yield of ginger. Samanhudi *et al.* (2014) [22] conducted a trial to study the effect of organic manure and arbuscular mycorrhizal fungi on growth and yield of young ginger, the results obtained indicated that application of organic manures (chicken manure, goat manure and cow manure) have the same effect to improve the growth and yield of ginger on the variables of plant height, number of leaves, number of tillers, plant fresh weight, plant dry weight and the fresh weight of rhizome. Mycorrhizal treatment at various doses (5, 10 and 15g/plant) can increase the plant height, number of leaves, and number of tillers and fresh weight of ginger rhizome. Singh (2015) [23] reported that soil application of FYM @ 30 t/ha + N: P: K: 80:50:80 kg/ha produced the maximum plant height, number of tillers/plant, number of leaves/tiller and yield giving the maximum net profit.

4. Turmeric (*Curcuma longa*)

Turmeric is a plant that has a very long history of medicinal use dating back nearly 4000 years. It finds its use as food stuff, cosmetic and medicine. It is widely used as spice in South Asian and Middle Eastern cooking. It lends curry its distinctive yellow colour and flavour. Turmeric is used as herbal medicine for rheumatoid arthritis, chronic anterior uveitis, conjunctivitis, skin cancer, small pox, chicken pox, wound healing, urinary tract infections and liver ailments (Dixit *et al*., 1988) [24]. It has anti-inflammatory, chloretic, antimicrobial and carminative action (Mills and Bone, 2000) [25]. It is used as an antiseptic for cuts, burns and bruises and as an antibacterial agent. Turmeric is currently used in the formulation of several sunscreens. Several multinational companies are involved in making face creams based on turmeric. In Ayurvedic medicine turmeric is a well-documented treatment for various respiratory conditions. Turmeric being a long duration exhaustive crop responds well to nutrition. Results of few studies conducted to evaluate the effect of organic sources in turmeric are presented: Kamal and Yousuf (2012) [26] reported that application of cowdung, poultry manure, mustard cake and neem cake have significant influence on growth and yield parameters and quality of turmeric. However, plants with neemcake performed better in terms of yield and yield attributes than that of other manures. In a study conducted by Ravindra Kumar *et al*. (2015)[27] it was observed that application of FYM @ 15 t/ha + vermicompost @ 3.8 t/ha + neem cake @ 1.5 t/ha significantly increased the plant height, number of tillers, leaf area, stem girth, fresh rhizome yield, projected dry yield, curing (25.25%), curcumin (5.3%) and essential oil (4.2%) and also registered maximum net returns, highest B:C ratio. In another trial conducted at Vegetable Research Farm, Department of Horticulture, Sam Higgingbotom Institute of Agriculture, Technology and Sciences by Chamroy *et al*., (2015) [28] indicated that application of 50% N (urea) + 50% N (poultry manure) recorded highest plant height, leaf length, leaf width, leaf area, number of leaves/plant and number of tillers/clump, fresh rhizome yield, dry rhizome yield and curcumin content. Results of the trial conducted by Jana *et al.* (2017) [29] at Uttar Banga Krishi Vishwavidyalaya, Pundibari revealed that application of 75% recommended inorganic nitrogen with Azospirillum @ 5 kg/ha and FYM @ 15 t/ha gave the highest yield of 26.29 t/ha as against 22.96 t/ha in the control (RDF – 80:80:120 kg N: P2O5:K2O per hectare was considered as control). Anuradha *et al.* 2018 [30] reported that the application of 50% RDN through inorganic source and 50% RDN through pongamia cake resulted in maximum number of mother rhizomes, primary rhizomes and secondary rhizomes per clump.

5. Ocimum (***Ocimum spp.***)

Ocimums are important group of aromatic and medicinal plants which yield many essential oils and aroma chemicals and find diverse uses in perfumery and cosmetic industries as well as indigenous system of medicine. Ocimum species with oil rich in camphor, citral, geranial, linalool, linyl acetate methyl chavicol, eugenol and thymol are important and can be harnassed for successful utilization by the industry. Among the various Ocimum species, *Ocimum basilicum* L. is commercially and extensively cultivated for essential oil production. Its oil is employed for flavouring of food stuffs, confectionery, condiments and in toiletry products such as mouth washes and dental creams. It is also used in flavouring of foods such as spiced meats, sausages, tomato pastes, fancy vinegars, pickles, ketchups and beverages. In the perfumery industry, the oil is used for compounding certain perfumes notably jasmine blends. It is used as a febrifuge and antimalarial plant. The juice obtained from the leaf gives relief to irritation of throat, ear ache and ring worm infections. Seeds are used internally for the treatment of constipation and piles (Joy *et al*., 2001) [31]. Basil leaves and shoots are used fresh or dried in culinary applications (Grayer *et al*, 2004 [32] ; Ozcan *et al*., 2005) [33]. Studies have reported that sweet basil contains high concentration of phenolic compounds (rosmarinic and caffeic acid), which are characterized by high antioxidant capacities (Lee and Scagel, 2009) [34]. Like any other plant, Ocimum requires the right kind of nutrients to sustain its growth. The use of organic manures is one technology that has been exploited over time and across ages because of its ability to restore soil fertility, supply major nutrients such as N, P, K, Ca, Mg and also stabilizes soil pH (Sanchez and Miller, 1986) [35]. The results of few trials conducted to study the response of ocimum to application of organic sources is presented: Rahman *et al*. (2014) [36] conducted an experiment to evaluate the effect of fertilizer and manures on the growth and yield of Ocimum. There were six treatments consisting of control, cowdung, poultry

manure, cowdung + NPK fertilizer, poultry manure + NPK fertilizer and mixed fertilizer. All the treatments significantly influenced most of the growth and yield components. The plant height, no. of branch/plant, no. of leaf/plant, leaf length, 1000 fresh leaf weight and fresh yield were highest where cow dung was applied and lowest in control. In another study carried out by Vijaya Rachel and Sirisha (2016) [37] it was reported that the application of biofertilizers promoted healthy growth of Ocimum plants, increased the secondary metabolite production which augmented in antioxidase activity. The application of organic Agrobiosol and neem cake in Ocimum increased the herbage yield by 33 and 47.75% respectively when compared to control (Eirini Sarrou *et al*., 2016) [38]. Osuagwu (2008) [39] studied the effect of different levels of poultry manure on the phenol, flavonoid and steroid concentration of the leaves of *Ocimum gratissimum* and reported that 20g and 25g treatment levels induced highest concentration of phenols and flavonoid, while 5g and 10g treatment levels produced the highest steroid content.

6. Lemon grass (***Cymbopogon spp***.)

Lemongrass is a tropical perennial grass which yields aromatic oil containing 70-90% citral. The name lemongrass is given to this crop because of typical strong lemon like odour of the plant which is predominantly due to the high citral content in the essential oil present in the leaves. Lemongrass is popularly known as Cochin oil in the world trade as 90% of it is coming from Cochin port. Kerala has the monopoly in the production of lemon grass oil. Lemon grass oil is one of the most important essential oils being widely used for the isolation of citral which can be converted into ionones. They are used in flavours, cosmetics and perfumes. β ionine is used for the commercial synthesis of vitamin A. In some far eastern countries like Java, Japan, China and India the leaves are used for flavouring foods, drinks and tea and for scenting bath water. The oil is used as repellent against flies and mosquitoes. Organic farming is gaining momentum especially in the cultivation of medicinal and aromatic plants owing to reputed improvements in the quality of produce under organic system of farming as well as the price premiums for certified produce. The results of few trials conducted to evaluate the effect of organic sources in lemon grass are presented: Shahi and Singh (2013) [40] conducted field trial to evaluate the effect of different nutrient sources in lemon grass. The results of the trial revealed that 100% N application through poultry manure produced the highest herbage yield as compared to RDF (40:60:40 kg/ha), 50% NPK + FYM @ 5 t/ha, green leaf manuring @10 t/ha + FYM @ 10 t/ha and 100% N through vermicompost. In another experiment conducted by Srinivas *et al*. (2017) [41] it was reported that application of flyash @ 6 t/ha + vermicompost @ 4 t/ha can be recommended where the cost of inputs can be compensated with high herb yield and in turn essential oil yield. Results of an experiment conducted by Gajbhiye *et al*., (2013)[42] revealed that all the growth parameters, herbage yield, dry matter yield of lemon grass increased with the application of 10t FYM/ha and 120:60:60 kg NPK/ha. Oil content was superior with the application of 5t FYM/ha and 60:30:30 kg NPK/ha, whereas 5t FYM/ha and 90:45:45 kg NPK/ha recorded the highest oil yield.

7. Mint (***Mentha spp.***)

Mints are aromatic perennial herbs with quadrangular stems and bearing leaves with essential oil in glands located in the subcuticular region. Among the various types of mints, only Japanese mint is cultivated in the tropics or subtropics with a cooler climate. It is generally cultivated as primary source of menthol, which is widely used for flavouring toothpastes, candies, beverages, confectionery, chewing gums, and mouth washes and for scenting shaving creams, tobacco, cigarettes, aerosols, polishes, hair lotions and lipsticks. It is also employed in a number of medicinal preparations like ointments, pain balms, cough syrups, cough lozenges and tablets. Choices for organically grown products are increasing due to the perception that they are healthier than those grown with synthetic fertilizers. The results of few trials conducted to study the effect of organic sources in mint is presented: Andressa Giovannani Costa *et al.* (2013) [43] conducted study to evaluate the effects of organic fertilizer sources on the biomass production, yield and chemical composition of pepper mint essential oil. The experiment was conducted using CRD design with 2x5 factorial scheme, two sources of manure (cattle and poultry), five doses (0, 3, 6, 9 and 12 kg/m^2) with four replicates. Different doses of cattle and poultry manure significantly affected plant biomass and the responses of other variables including leaf area, leaf weight ratio, leaf area ratio, root:shoot ratio, yield and chemical composition. Organic fertilizer doses of 9.0 kg/m^2 cattle manure and 8.3 kg/m^2 poultry manure registered maximum total dry biomass. The highest yield of essential oil was obtained by applying 11.8 kg/m^2 poultry manure. Differences in the chemical composition of the essential oil were observed for only three components (menthione, pulegone and menthyl acetate) without significant change in the menthol content. The results of a pot culture study conducted revealed that application of vermicompost @ 2.5 t/ha plus humic acid 0.2% and panchagavya 3% resulted in improving the growth characters like plant height, plant spread, number of laterals, number of leaves and leaf area. The herbage yield, dry matter production, chlorophyll content was also favourably influenced by this treatment (Prabu and Arumugam Shakila, 2013) [44]. In another trial conducted by Rahman *et al*., (2014) [36] plant height, no. of branch/plant, no. of leaf/plant, leaf length, 1000 fresh leaf weight and fresh yield were highest with the application of cowdung. Results of experiment conducted by Rajamanickam *et al*., (2011) [45] at Medicinal plant unit, Annamalai University revealed that application of 100% NPK + vermicompost @ 5 t/ha + consortium of biofertilizers (CBF) recorded the highest nutrient uptake, dry matter production and fresh herbage yield. However application of 75% NPK + vermicompost @ 5 t/ha + CBF resulted in maximum profitability.

Conclusion

The use of organic sources either as sole or in combination with inorganics helped in augmenting the yield and quality parameters in medicinal and aromatic plants. The inclusion of organics in nutrient management practice will help the growers in reaping higher yields and in turn higher profits.

References

1. Roy Upton, Pavel Axentiev MS, Diana Swisher MA. *Aloe vera* Leaf. American Herbal Pharmacopoeia. 2012, 1-52.
2. Saeed MA, Ahmad I, Yaqub U, Akbar S, Waheed A, Saleem M. *et al*. *Aloe vera* : A Plant of Vital Significance. Science Vision. 2004; 9:1-3.
3. Patidar A, Bhayadiya RK, Nimita M, Pathan JK, Dubey PK. Isolation of Aloin from *Aloe vera*, its characterization and evaluation for antioxidant activity.

International Journal of Pharmacy Research and Development. 2012; 2(4):24-28.
4. Rajeshwari R, Umadevi M, Sharmila Rahale, Pushpa R, Selvavenkadesh, Sampath Kumar KP. *Et al*. *Aloe vera*: The Miracle plant, its medicinal and traditional uses in India. Journal of Pharmacognosy and Phytochemistry. 2012; 1(4):118-124.
5. Saha R, Patil S, Ghosh BC, Mittra BN. Performance of *Aloe vera* as influenced by organic and inorganic source of fertilizer supplied through fertigation. Acta Horticulturae. 2005; 676:171-175.
6. Krishna Moorthy S, Malliga P. Plant characteristics, growth and leaf gel yield of *Aloe barbadensis* Miller as affected by cyanopith biofertilizer in pot culture. International Journal of Civil and Structural Engineering. 2012; 2(3):884-892.
7. Hasanuzzaman M, Ahamed KU, Khaleequzamman KM, Shamsuzzaman, MM, Nahar K. Plant characteristics, growth and leaf yield of *Aloe vera* as affected by organic manures in pot culture. Australian Journal of Crop Science. 2008; 2(3):58-163.
8. Rajendran A, Gnanvel I. Effect of organic manures and spacing on *Aloe vera* L. Journal of Medicinal and Aromatic Plant Sciences. 2008; 30(1):40-42.
9. Guleria V, Vashisht A, Gupta A, Salven T, Thakur C, Kumar D. Response of *Aloe vera* to organic sources of nutrients under rainfed conditions. Medicinal Plants. 2013; 5(3):159-163.
10. Hoseini NA, Golchin A, Mohammadi J. The effect of organic fertilizers and organic wastes on *Aloe vera* growth and development. Annals of Biological Research. 2013; 4(8):90-95.
11. Anonymous. The Wealth of India. A Dictionary of information Resource on Plants, Animals and Minerals. 2004.
12. Maheshwari SK, Sharma RK, Gangrade SK. Response of ashwagandha to organic manures and fertilizers in shallow black soils under rainfed conditions. Indian Journal of Agronomy. 2000; 45(1):214-216.
13. Mohanalakshmi M, Vadivel E. Impact of organic manures and bioregulators on root yield and associated characters in ashwagandha (*Withania somnifera* (L.) Dunal). International Journal of Agriculture, Environment and Biotechnology. 2009; 2(4):379-384.
14. Shimrayngayung. Effect of manures, inorganic fertilizers and biofertilizers on growth and yield of Ashwagandha (*Withania somnifera* Dunal.). M.Sc. Thesis submitted to ANGRAU, Hyderabad. 2008.
15. Guruprasad, Mahabaleshwar Hegde, Sangana Goud PR, Sheshagiri KS. Influence of organic manures on growth and yield in Ashwagandha (*Withania somnifera* Dunal.) Environment and Ecology. 2014; 32(2A):762-766.
16. Ashashri Shinde, Pankaj Gahunge, Paramaveer Singh, Sudipt Kumar Rath, Naresh Khemani. Effect of inorganic fertilizers and organic manures on growth, quality and yield of ashwagandha (*Withania somnifera* Dunal) cv. Jawahar Ashwagandha-20. Annals of Pharmacy and Pharmaceutical Sciences. 2013; 4 (1, 2):13-16.
17. Chen JC, Huang L, Shiblu W, Hsiang C. Ginger and its bioactive component in inhibiting entero toxigenic Escherichia coli -heat -labile. Journal of Agriculture and Food Chemistry. 2007; 55(21):8390-8397.
18. Earnest E, Pittler MH. Efficacy of ginger for nausea and vomiting: A systematic review of randomized clinical trial. British Journal of Anaesthesia. 2008; 84(3):367-371.
19. Kim JS, Park S, Hyewon Y, Jaetteon S. Cytotoxic components from the dried rhizomes of *Zingiber officinale* Roscoe. Archives of Pharmacal Research. 2008; 31(4):415-418.
20. Shaikh AA, Desai MM, Shinde SB, Tambe AD. Yield and nutrient uptake of ginger (*Zingiber officinale* Rose.) as affected by organic manures and fertilizers. International Journal of Agricultural Sciences. 2010; 6(1):28-30.
21. Egbuchua CN, Enujeke EC. Growth and yield responses of ginger (*Zingiber officinalis*) to three sources of organic manures in a typical rain forest zone, Nigeria. Journal of Horticulture and Forestry. 2013; 5(7):109-114.
22. Samanhudi, Ahmad Yunus, Bambang Pujiasmanto, Mujri Rahayu. Effect of organic manure and arbuscular Mycorrhizal fungi on growth and yield of young ginger (*Zingiber officinale Rosc*.). IOSR Journal of Agriculture and Veterinary Science. 2014; 7(5):1-5.
23. Singh SP. Nutrient supplementation through organic manure for growth and yield of ginger (*Zingiber officinale Rose.*). Journal of Ecofriendly Agriculture. 2015; 10(1):28-31.
24. Dixit VP, Jain P, Joshi SC. Hypolipidaemic effects of *Curcuma longa* L. and *Nardostachys jatamansi*, DC intriton induced hyperlipidaemic rats. Indian Journal of Physiology and Pharmacology. 1988; 32:299-304.
25. Mills S, Bone K. Principles and Practices of Phytotherapy. Toronto, ON: Churchill Livingstone, 2000.
26. Kamal MZU, Yousuf MN. Effect of organic manures on growth, rhizome yield and quality attributes of turmeric (*Curcuma longa* L.). The Agriculturists. 2012; 10(1):16-22.
27. Ravindra Kumar K, Narasimha Rao S, Raj Kumar N. Effect of organic and inorganic nutrient sources on growth, quality and yield of turmeric (*Curcuma longa* L.). Green Farming. 2016; 7(4): 889-892.
28. Chamroy T, Rajwade VB, Bajad VV. Effect of organic and inorganic manurial combinations on turmeric (*Curcuma longa* L.). Plant Archives. 2015; 15(1):67-69.
29. Jana JC, Datta S, Bhaisare PT, Thapa A. Effect of organic, inorganic source of nutrients and Azospirillum on yield and quality of turmeric (*Curcuma longa* L.). International Journal of Current Microbiology and Applied Sciences. 2017; 6(2):966-970.
30. Anuradha UB, Patil, Karubar AR, Ramesh G, Hiregounder S. Effect of Integrated Nutrient Management on growth and yield of Turmeric (*Curcuma longa* L.). International Journal of Current Microbiology and Applied Sciences. 2018; 7(1):3196-3203.
31. Joy PP, Thomas J, Mathew S, Jose G, Joseph J. Aromatic Plants. Tropical Horticulture. 2001, 2.
32. Grayer RJ, Vieira RF, Price AM, Kite GC, Simon JE, Paton AJ. Characterization of cultivars within species of Ocimum by exudates flavonoid profiles. Biochemical Systematics and Ecology. 2004; 32(10):910-913.
33. Ozcan M, Arslan D, Unver A. Effect of drying methods on the mineral content of basil (*Ocimum basilicum* L.). Journal of Food Engineering. 2005; 69(3):375-379.
34. Lee J, Scagel CF. Chicoric acid found in basil (*Ocimum basilicum* L.) leaves. Food Chemistry. 2009; 115:650-656.
35. Sanchez PA, Miller RH. Organic matter and soil fertility management in acid soils of the tropics. Transactions 13th

International Congress Soil Science, Hamburg.1986; 6:609-625.
36. Rahman KM, Sattar MA, Rahman GMM. Effect of fertilizers and manures on growth and yield of Tulsi and Pudina medicinal plant. Journal of Environmental Science and Natural Resources. 2014; 7 (2):13-16.
37. Vijaya Rachel K, Sirisha VD. Effect of biofertilizers application on qualitative, quantitative yield of phytochemicals in three divergent groups of plants and their antioxidant activities. Research Journal of Life Sciences, Bioinformatics, Pharmaceutical and Chemical Sciences. 2016; 2(3):56-77.
38. Eirini Sarrou, Puschalina Chatzoupoulou, Theodorus Koutsos V, Syavros Katsiotis. Herbage yield and essential oil composition of sweet basil (*Ocimum bacilicum* L.) under the influence of different mulching materials and fertilizers. Journal of Medicinal Plant Studies. 2016; 4(1):111-117.
39. Osuaguru GGE. The effect of rate of application of poultry manure on the phenol, flavonoid and steroid part of the leaves of *Ocimum gratissimum*. Journal of Sustainable Agriculture and the Environment. 2008; 10(2):106-111.
40. Shahi VB, Singh PN. Effect of organic and inorganic sources of nutrients on yield and yield attributes of lemon grass (*Cymbopogon flexuosus*). Annals of Horticulture. 2013; 6(1):49-55.
41. Srinivas P, Vijay Padma SS, Pandu Sastry K, Sunitha KB. Analysis the effect of flyash and vermicompost combination on herb yield, oil content and oil composition of lemon grass (*Cymbopogon flexuosus* Nees). International Journal of Pure and Applied Biosciences. 2017; 5(4):1710-1717.
42. Gajbhiye BR, Momin YD, Puri AN. Effect of FYM and NPK fertilization on growth and quality parameters of lemon grass (*Cymbopogon flexuosus*). Agricultural Science Research Journal. (2013); 3(4):115-120.
43. Andressa Giovannini Costa, Suzan Kelly Vilela Bertolucci, Jorge Henrique Chagas, Elza Oliveira Ferraz, Jose Eduardo Brasil Pereira Pinto. Biomass production, yield and chemical composition of peppermint essential oil using different organic fertilizer sources. Ciencia e Agrotecnologia, Lavras. 2013; 37(3):202-210.
44. Prabu M, Arumugam Shakila. Studies on organic nutrition in growth and yield of Japanese mint (*Mentha arvensis* L.). Asian Journal of Horticulture. 2013; 8(1):126-128.
45. Rajamanickam V, Venkatesan S, Arumugam Shakila. Effect of organic manures, consortium of biofertilizers and inorganic fertilizers on yield, nutrient uptake and profitability of mint (*Mentha arvensis* L.). Asian Journal of Horticulture. 2011; 6(1):191-194.