



Eco-Agriculture for Herbs & Bioactives Trade, Export, Biodiversity Conservation and Consumer Health in India

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Abstract

Medicinal Plants trade has grown by 100% to over 0.6 million ton/ year in the past 2 decades in India mainly due to the growth in the consumption of cultivated herbs such as Mint, Holy Basil, Indian Ginseng and spices. Wild medicinal plants comprised 70-80% of the raw material (about 0.3 million ton/year) in 20th century. About 200 i.e. 25% of the highly traded species (800) face overharvest driven extinction risk. However, emergence of the herbal industry (single, simple species) besides the growth of the traditional Ayurvedic industry (multi-species, complex) doubled the cultivation stock share to 50% e.g. Psyllium and Drumstick. Polyphenols are the emerging bioactive principles in the herbs, as the key drivers of the medicinal effect, besides erstwhile alkaloids and steroidal saponins etc. that won fame earlier. Hence, various eco-agri-techniques to increase polyphenol contents in herbs are identified viz. a) varietal breeding, b) organic inputs, c) mycorrhiza/ bio-fertilizers, d) micro-nutrients, e) cultural/ agronomic practices f) elicitors. Such agri-techniques can improve the active ingredient especially polyphenol content by 50% to 100% and is profitable for the manufacturing industry and the farmers. Indian Government has supported medicinal plants cultivation for the last 2 decades especially of the threatened herbs but it needs to improve by natural farming (NF) techniques and labeling the ingredient content, safety parameters with industry partnership and species in export demand.

Keywords: Medicinal Plants; Ecorestoration; Natural Farming; Health; Phytochemicals

Abbreviations

IUCN: International Union for Conservation of Nature; TSM: Traditional Systems Of Medicine; NTFP: Non Timber Forest Produce; NMPB: National Medicinal Plants Board; TCM: Traditional Chinese Medicine; NSAID: Non Steroidal Anti Inflammatory Drugs; NMPB: National Medicinal Plants Board; NRI: Non Resident Indians; CSR: Corporate Social Responsibility.

Introduction

Medicinal Plants and spices in regular diet have been the foundation of health and well-being in India for millennia. Its benefits include for instance low cancer incidence (89 per 0.1 million) in India which is 50% of the global average (197) and 25% of the EU (363) or USA (387) [1,2]. This may indicate better immunity, possibly due to the higher spice consumption in India as proposed by researchers in

USA [1]. Higher spice consumption is also linked to higher immunity and lower disease burden in the recent pandemic of COVID-19 during 2020-22 [3]. Medicinal plant trade in India comprised 90% wild sourced species around 1990 and 80% by 2005 [4]. Exports comprised below 25% extent of the trade. Ever-growing demand far over-stripped the supplies for decades and had resulted in about a quarter (about 192) of the main traded medicinal plants (>100 ton/ year volume, total 812 species) to face heavy stock depletion and some extinction risk (*ibid.*). For, these 192 species were classified as threatened (>30% population decline) by the criteria of IUCN (International Union for Conservation of Nature) (*ibid.*). Hence, continued growth of Ayurved, Siddha, Unani, Homeopathy, Tibetan (termed as “AYUSH” in the Indian policy) and such traditional systems of medicine (TSM) in India was at risk due to the growing shortage of the herbal raw materials.

However, rapid emergence/ growth and rising export of the corporate like Dabur, Patanjali, Emami, Himalaya Drug co. Ltd. contradicts this view of herbs rarity due to 4 possible factors-

- Wide cultivation of threatened species such as Meswak e.g. Dabur co. *Salvadora Persica* [5].
- Rapid growth of the “herbal” stream of medicines similar to but different from the TSM, enabled this paradigm shift. For, “herbal” drugs often comprise 1 or 2 species, is simple to process and easy to communicate to the customer in terms of its active ingredients or effects. Moreover, they are mainly cultivated with no extinction risk. For instance, Turmeric cream for growing, soft, disease free skin or Clove toothpaste for strong, pain-free teeth. Curcumin is the famous bioactive principle of Turmeric [1]. On the contrary, TSM comprise of many species, multiple active principles and salient effects sometimes beyond ordinary comprehension.
- The herbal sector also grew by penetrating allied subjects such as bodycare, cosmetics, perfumery and sanitation etc. such as herbal soaps and body lotions, mostly as single herbs and even spices/ aromatic oils e.g. Turmeric lotion or Sandalwood oil/ paste for skincare.

- Further, the herbal industry captured niche, high return streams such as cosmetics and sanitary, unlike the TSM. Similarly, the top 2 herbs exported from India are also widely cultivated- Isabgol Psyllium- *Plantago ovata* [6] and Senna *Cassia senna* [7] - both used mainly as laxatives in the west. Some are hyped as anti-obesity such as Camboge [8].

These 3 factors enabled the medicinal plants trade to grow 35% over 2005 by 2015-16 (0.51 million ton/ year) in a decade [9] since its 1st national level estimate in 2004-05 [4]. The 2004-05 estimate comprised 0.233 million ton/ annum- mtpa- domestic 0.177 mtpa & export- 0.056 mta, while other 0.86 mtpa was collected and self consumed by rural families as per the sample survey estimate, with total of 3 components being 0.32 million ton [4]. The same team estimated the rise in herbal trade in a decade (2015-16) by 30% thus totaling to 0.3 million ton vide table 7.1 from 34 mandis (markets) survey [8]. We did not consider here the household, subsistence consumption and today many villagers also prefer buying herbal products - for medicine, personal care or sanitation purposes, with increased sales volume. Indian Government also thus pushed medicinal plants cultivation widely by promotional schemes by setting up national & state medicinal plants boards [10].

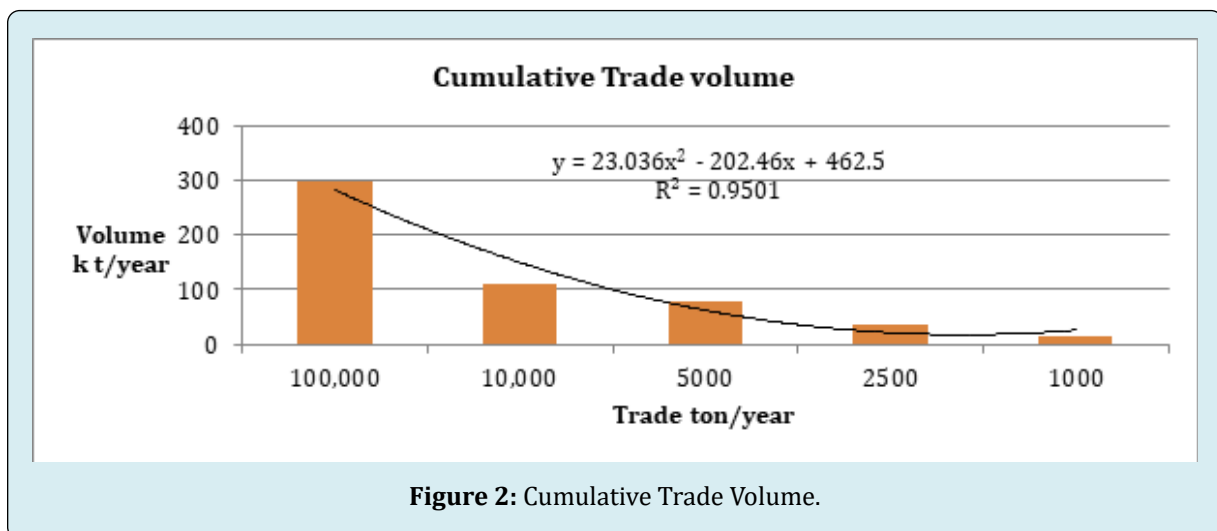
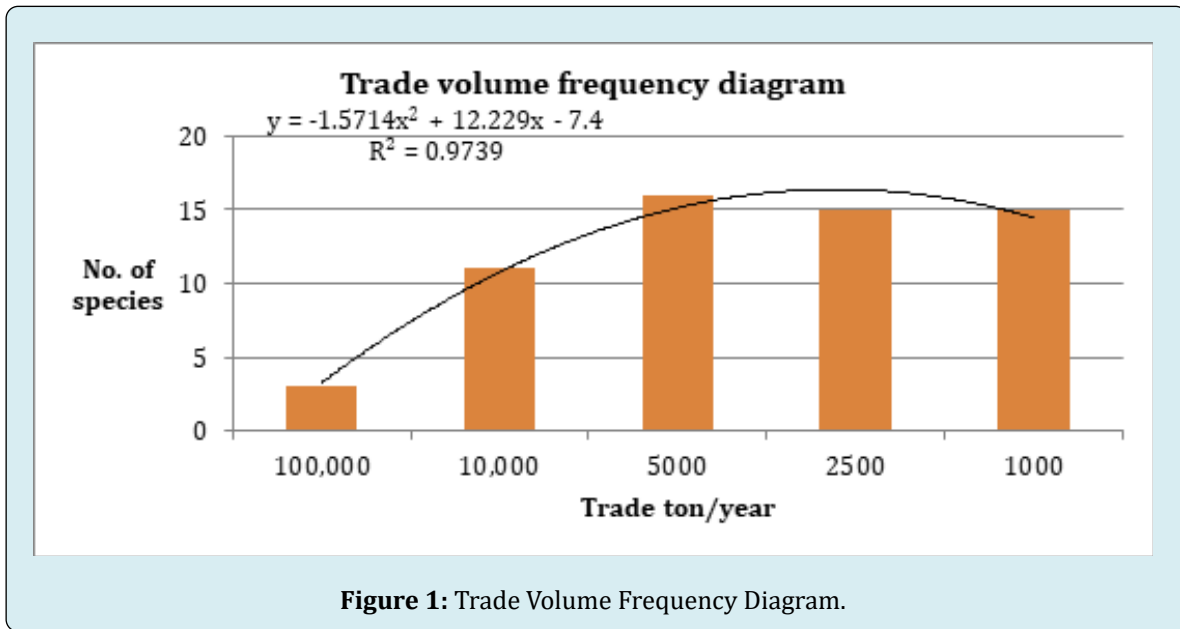
Methodology

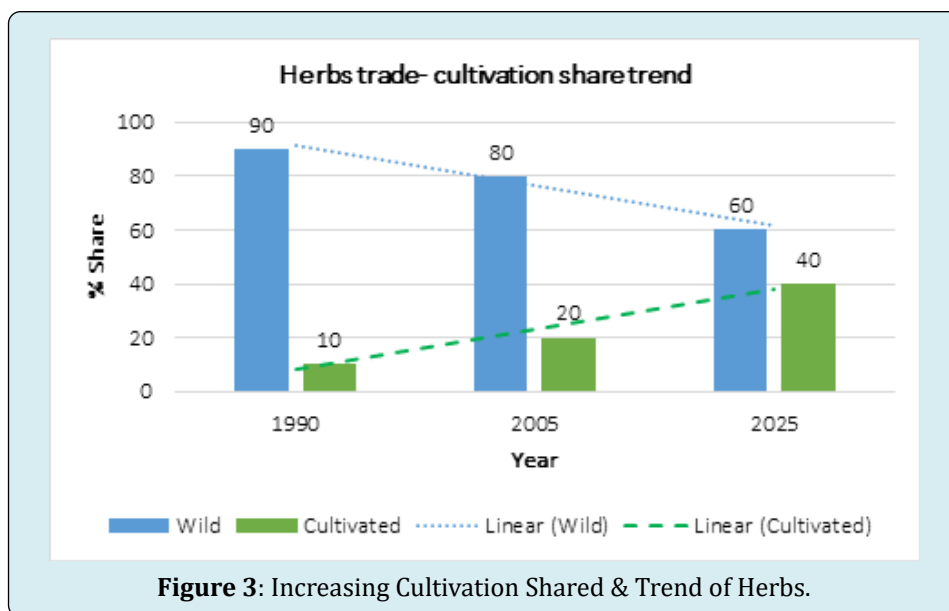
We conducted survey of herbal trade in different Indian states by sampling markets & traders in terms of main species traded, volumes & prices, during 2013 in a project sponsored by Christina Aid NGO to study livelihood development potential of non timber forest produce (NTFP)/ herbs. It was conducted in 13 states in collaboration with 12 NGOs including 1 community owned microenterprise- gram Mooligai co. Ltd. (GMCL) & coordinated by the second author through the NGO CCD (www.ccd.org.in). Table 1 enlists the study states & partners. They were provided study methodology orientation, formats by CCD NGO who conducted the results consolidation.

STATE	NGO	Team leader
1. Uttarachal	AGAS	Mr J P Maithani
2. Himachal Pradesh	Abilashi College, Lokvigyan	Prof. Suresh, Mr Prakash Bhandari
3. Rajasthan	Jagran	Dr G P S Jhala
4. Madhya Pradesh	Vrunda	Ms Tripti Singh
5. Uttar Pradesh	Samarpan	Mr Radheshaym
6. Chhattisgarh	Vaidya Sangh	Mr Nirmal Awasthi
7. Jharkhand	Rudra	Mr Shahid Ashraf
8. Orissa	Prakruti	Mr Bismaya Dalei

9. Maharashtra	CCD	Dr Utkarsh Ghate & Vd. Mandar Akkalkotkar
10. Karnataka	LIFE	Mr Narsimha Hegde
11. Andhra Pradesh	CAFED	Mr Showri Raju
12. Tamilnadu	GMCL	Mr John Britto
13. Kerala	ESPCL	Mr Benjamin

Table 1: Study States & Partner Ngos for Medicinal Plants Trade Study in India.





Results

Top Wild Collected Species

The top 27 traded medicinal plants in India & their active ingredients & ailments they are effective in are depicted in

Table 1. The trade volumes estimates from our study are triangulated with the average of values from studies by NBRI (National Botanical Research Institute) [11], Govt. of India taskforce [12] and Transdisciplinary University [4,9]. Himalayan plants occur the high elevation only, in limited area and rare, so with low volumes so are not visible here.

Sn	Species	Botanical Name	Bioactives	Quantity K Tpa@
1	Amla#	<i>Phyllanthus emblica</i>	Vitamin C, tannins, phenols	100
2	Drumstick#	<i>Moringa olifera</i>	Calcium, polyphenols	100
3	Isabgol	<i>Plantago ovata</i>	Fibre	100
4	Senna#	<i>Cassia senna</i>	Sennosides	10
5	Harrra	<i>Terminalia chebula</i>	Tannin, Chebulic acid	10
6	Behera	<i>Terminalia bellerica</i>	Gallic acid, Ellagic acid	10
7	Giloy	<i>Tinospora cordifolia</i>	Terpenoids (Tinosporide)	10
8	Tulsi	<i>Occimum sanctum</i>	Eugenol	10
9	Charota/ Pavad	<i>Cassia tora##</i>	Sennesoids	10
10	Lemongrass#	<i>Cymbopogon martinii</i>	Citral	10
11	Ashwagandha#	<i>Withania somnifera</i>	Withanoloides	10
12	Dashmul	10 species roots	Flavanoids	10
13	Salai#*	<i>Boswellia serrata</i>	Boswellic acid	10
14	Mulethi (Licorice)	<i>Glycyrrhiza glabra</i>	Glycirrhizin	10
15	Arjuna	<i>Terminalia arjuna</i>	Arjunol	5
16	Bael#	<i>Aegle marmelos</i>	marmesin, angeline,	5
17	Kutaj	<i>Holarrhena antidysentrica</i>	Conessine, Holarrhemine	5
18	Satavar#	<i>Asparagus racemosus</i>	Saponin	5
19	Bramhi #	<i>Bacopa moneri</i>	Bacoside	5
20	Adusa/ Vasaka	<i>Adathoda vasaca</i>	Vasicine	5

21	Nagarmotha#	<i>Cyperus rotundus</i>	Cyperon	5
22	Asoka*#	<i>Saraca asoca</i>	Catechol	5
23	Guggul*	<i>Commiphora wightii</i>	Terpenoids	5
24	Nirgundi	<i>Vitex negundo</i>	Vasicine	5
25	Gokharu	<i>Trubulus terrestris</i>	Protodioscin (saponin)	5
26	Dhavai/ Dhayti	<i>Woodfordia fruticosa</i>	Quercetin, Kaempferol, Gallic acid	5
27	Bhringraj	<i>Eclipta alba</i>	Wedelic acid	5
	@- k tpa= k ton/ annum	(k= 1,000)	TOTAL	475

Table 2: Herbs Trade Volume Estimate.

#- cultivated *- 90% is imported or adulterated as Indian produces only 5-10%

*#- adulterated by Sal (*Shorea robusta*) & False Ashok (*Polyalthia longifolia*) trees

##- much exported earlier but less today in foods due to anthroquinine in it

Today its mainly a gum in the textile industry, less in food products/ medicine.

##*- cultivated widely for pulp by paper mills in Madhya Pradesh earlier.

NOTE: The above 27 species with 5,000 ton/ year or above volume comprise 80% of the total trade, estimated over 500 million ton/ year. Other hundreds of species do little volume addition as figure 1, 2 & 3 show.

Wild collected or 'wild crafted' herbs were preferred over the cultivated ones for long in belief of their superior quality. However, research has shown cultivated herbs to also possess similar or better quality [13,14]. Various natural abiotic and biotic stresses cause the secondary metabolite production having medicinal value. As these are prevalent in the wild environment while the cultivation has ample nutrient & irrigation supply, pest and disease control measure, the stress is absent & hence, the low potency of herbs, it was presumed. However, stress can be induced in the cultivation by controlling the input factors such as irrigation volume or frequency (e.g. herbs like *Aloe vera* are not irrigated 40-50 days before harvest for higher potency) and other techniques mentioned later. Further, the bioactive ingredient- "sennosides" quantity is higher if the Senna crop is not irrigated much [7]. Simulating wild like conditions in forestry cultivation is called "analog forestry" and is useful

to produce herbs with high potency due to the natural stress factors [15].

Cultivated Herbs

Industry today prefers cultivated medicinal plants over the wild globally, due to the uncertainty of the supply in future (inter annual variations & policy issues- threatened plants conservation related), quality variations (active ingredients) and contaminants. There are instances of fluoride content in the herbs such as Bramhi from certain regions (.e.g. near Howrah) or effluents that are beyond the farmer's control but industry can select other zones to source such herbs to get clean raw drugs.(Agarwal A., NRPL, pers. Comm.. Table 3 below enlists the top traded cultivated 20 herb species in India, including 4 spices, noted in our field study (marked **).

Trade Name	Local Name	Species (\$- Spice)	Active Principle	Class
Aloe vera	Kumari	<i>Aloe vera</i>	Anthroquinine, emodin	B
Asafoetida#	Hing	<i>Ferula asafetida</i>	Disulphides, Ferulic acid	C
Andrographis	Kalmegh	<i>Andrographis paniculata</i>	Andrographalite	C
Chinarose	Gudhal	<i>Hibiscus rosa chinensis</i>	Anthocyanin	E
Cinnamon**	Tejpat, Dalchini	<i>Cinnamoum verum</i>	Cinnamaldehyde	B
Ginger**	Adrak, Sunthi	<i>Zingiber officinalis</i>	Gingerol, Shagaol	A
Henna*	Mehendi	<i>Lawsonia inermis</i>	Lawsonic acid (Henna acid)	A
Holy Basil	Tulsi	<i>Occimum sanctum</i>	Eugenol, Rosmarinic acid	A
Indian Ginseng*	Ashwagandha	<i>Withania somnifera</i>	Withanoloid	C
Lemongrass	Malbar grass	<i>Cymbopogon flexuosus</i>	Citral	C
Licorice#	Mulethi	<i>Glycyrrhiza glabra</i>	Glycyrrhizin	A
Mint*	Pudina	<i>Mentha longifolia</i>	Menthol (monoterpenes)	A

Noni	Barmukhi	<i>Morinda citrifolia</i>	Terpens, sulfur	D
Nutmeg**	Jaiphal	<i>Myristic fragrance</i>	Myristicin	B
Pepper long	Pippali/ Marich	<i>Piper longum</i>	Piperine	C
Plumbago	Chitrak	<i>Plumbago zeylanica</i>	Plumbagin	D
Psyllium*	Isabgol	<i>Plantago ovate</i>	Sugars, fibre, uronic acid	A
Senna@	Sanoy	<i>Cassia senna</i>	Glycosides (sennesoids)	A
Sweet flag	Bach	<i>Acorus calamus</i>	Asarone, Eugenol	C
Turmeric**	Haladi	<i>Curcuma longa</i>	Curcumin, Turmeron	A

Table 3: Mainly Cultivated Herbs in India.

#- mainly imported, from west Asia, *- Exported, Class (volume k'000- tpa):- A>100, B- 50 C- 25, D- 10, E- 5.

Sources- (a) Psyllium- 1.2 lakh ton- export- 1 tpa= 0.1 million ha,

(b) Senna- 12,000 tpa, yield- 0.5 t/acre dry leaves*= 25,000- 80,000 ha [16],

(c) Aloe vera- Rs. 100 cr/yr# (-> 20,000 ha), yield 10 tpa, Rs. 50 k/ha income= 10,000 ha area. <https://krishijagran.com/agripedia/how-and-where-to-sell-aloe-vera/>,

Henna- 21,000 ha- 21,000 tpa- Rj-http://www.hennapage.com/. Volume classes are as per the table 2.

Spices also belong to this category of cultivated herbs and called as “kitchen clinic” or “nanny’s medi-kit” for millennia in India, used as home remedies or in preventive healthcare. Some spices (Cinnamon, Ginger, Nutmeg, Turmeric) are consumed in bulk in AYUSH drugs, at volumes > 1,000 ton/year vide table 3 [4,11].

Europe and USA, amongst other developed nations

prohibit the use of many main ingredient species of AYUSH drugs, as their safety and efficacy is not proven using the western methods. However, many leading spices and herbs are permitted in those countries, as food ingredients at least, if not medicines (Box 1) for instance, from Germany as a sample from the Europe [14], where herbal medicines/ food supplements are growing rapidly due to safety, and no adverse reactions.

Box 1: AYUSH Species Included in the Western Pharmacopeia

- 1- Vasaka- *Adhatoda vasica*
- 2- Guggulu- *Commiphora spp* (incl. wightii)
- 3- Garlic- *Allium sativum*
- 4- Satavar- *Asparagus racemosus*
- 5- Senna- *Cassia angustifolia/ senna*
- 6- Asafoetida- *Ferula asafoetida*
- 7- Licorice- *Glycyrrhiza glabra*
- 8- Mint- *Mentha piperita*
- 9- Nettle- *Urtica dioica*
- 10- Grape- *Vitis vinifera*
- 11- Ashwagandha- *Withania somnifera*
- 12- Ginger- *Zingiber officinalis*

Already some researchers/ companies such as Natural Remedies, Bangalore (<https://www.naturalremedy.com/>) are tapping this permitted herbs list to develop inventive products by modifying the existing herbal drugs e.g. Vasaka, Tulsi i.e., besides spices.

Discussion

Export Scope

Raw drugs comprise 67% i.e. 2/3rd of India’s export of AYUSH sector & the volume is ever-growing but the share

in total trade is declining as high value, finished medicines share is rising [12]. National Medicinal Plants Board (NMPB) website (<https://www.nmpb.nic.in/about-us>), claims 1178 species of medicinal plants are in trade of which 242 species have consumption above 100 metric tons/year. The domestic demand of medicinal plants is estimated at 1,95,000 (40%)

ton for the year of 2014-2015 and export at 1,34,500 ton (27%) in 2014-2015, of the total consumption of herbal raw drugs of 5,12,000 MT valued at \$ 80 million [8]. The export value grew much in the last 10 years .

Traditional Chinese medicine (TCM) that dominates the world herbal market has total export value (\$ 3.5 billion/year) which is 7 times higher value than AYUSH exports [17,18,19] and the 2 differ because -

- TCM has 90% value added (finished) products (medicines), just 10% raw drugs (herbs). AYUSH is the opposite- 70% raw drugs and 30% medicines value.
- In India, 70% of its raw material are wild sourced, unlike China where perhaps 70% raw materials are cultivated.

AYUSH industry had only 20% herbs from farming sector, but 80% from the wild [4]. This was a limiting factor as the forest productivity is limited, cannot sustain for long and is unreliable- quality and yield varies greatly year to year based on the climatic variations that are changing more recently. No wonder that about 10% of AYUSH herbs are rare/ threatened

and may longer be available in a few years from now as some nearly became extinct in the near past- Guggul (*Commiphora wightii*), Seeta Ashoka (*Saraca asoca*), Serpentina *Ravoulfia serpentina* [4]. These are either imported or adulterated/ substituted, often raising questions regarding drugs quality & efficacy.

Bioactive Ingredients

AYUSH research can benefit by study of active chemical ingredients of main herbs and their ayurvedic characterization and multiple species containing such chemical composition. This will help to standardize and reduce the extinction risk of threatened species. Polyphenols are important class of phytochemicals rapidly emerging as the dominant paradigm in the west today [20] box 2 and Ayush medicines often excel in it so this needs to be branded profitably e.g. Curcumin (4-6%) rich Turmeric latte (milk) as being done globally today after publications by USA researches at Texas university [1] in '90s on its healing benefits.

Box 2: Polyphenols- Emerging Herbal Cures.

Polyphenols are aromatic compounds in many fruits, vegetable and spices that are both immunity builders and anti-inflammatory [20]. Curcumin from Turmeric, Resveratrol from grapes (and red wine), EGCG (Epigallo catechin gallate), from Green tea, Gingerol from ginger, Quercetin from Onion & Coriander, are few famous polyphenols globally, that are even extracted, packed and sold in retail in sometimes. These are generally safe and being promoted as key ingredients of Superfoods such as Drumstick- used to reduce joint pains/ arthritis burden in the west [17,21]. Its promotion in India instead of costly or non-vegetarian options such as glucosamine is the need of the hour as majority of the people are vegetarian and Ayurvedic treatment is found as effective as NSAID (non steroidal anti inflammatory drugs) such as Glucosamine in the clinical trial conducted in the USA on rheumatoid arthritis patients [22]. AYUSH can profitably learn and use such modern terminology e.g. "superfood" for posterity and benefit the farmers [23].

Spices and cultivated herbs consumption may rise in future as 'health guards' due to their high anti-oxidant value and as some are permitted to replace threatened/ unavailable wild herbs if branded well though publicity and customer education on herbal health benefits. For instance, Satavari (*Asparagus racemosus*) is common Ayurvedic pharmacopeia substitute of Ashtavarga (8 herbs, rare Himalayan herbs) used in "Chyavanprash"- commonest TSM tonic in India [24]. Such legitimate substitution approach can save threatened herbs, consumers health & industry all [25]. Herbal drugs benefits are evident in better immunity, less incidence (<50,000 infections per 0.1 million population) & low mortality (<500 per 0.1 million population) in COVID-19 (23), possibly due to spice decoction consumed daily & cuisine rich in spices in most families [26].

Eco-Agro-Techniques for Quality

The herbs below are profitable herbs to cultivate, for instance, with ready export demand. Of these only Guggulu, Licorice & Asafetida are supported in the subsidy scheme of National Medicinal Plants Board (NMPB) (<https://www.nmpb.nic.in/content/prioritised-list-medicinal-plantscultivation>). These are in shortage/ imported so improving their production can help export and "make in India" mission. The other species need to be added to the NMPB subsidy scheme. Box 4 below mentions few such promising cultivation herb species. These differ from the top herbs traded globally such as Ginkgo & Ginseng, St. John's wort or salad dressing condiments like Oregano, Rosemary [17-19]. Thus, the Indian herbs exports are limited for not cultivating yet what the world market wants. Indian herbal

exports are mainly focused in countries where many non resident Indians (NRI) customer base such as the Gulf [17].

The ecological techniques employed in the emerging “natural farming” pathway to improve the quality of crops including herbs include the following Ghate U [27]-

- *Mix genepool*- Amla, the commonest Indian medicinal plant, a tree is has pollen self incompatibility. So large plantations may not yield fruiting, as they belong to the same variety, unless a wild tree exists nearby to enable cross fertilization.
- *Beekeeping*- pollination- wild variety, bees, especially of oilseeds/ seed spices.
- *Low Irrigation*- Avoid over-irrigation & stop irrigating 1-1.5 months before harvest, to create water stress and improve secondary metabolite content % by avoiding dilution,
- *Soil mixture, no till*- Lateritic or loam soil addition to clay or sandy soil and low tillage for better soil and crop quality,
- *Organic inputs*- cowdung, cow urine, farm yard manure, vermi-compost etc. besides microbial inputs such as especially Mycorrhiza, *Trichoderma* etc. for symbiotic growth
- *Cultural*- trimming, pruning etc. to induce stress on xylem/ phloem & nutrients, water.

Besides the following agri-techniques are successfully demonstrated for better quality of the produce-

- varietal breeding,
- micro-nutrients supply- Sulfur, Zinc, Calcium, Magnesium etc.
- elicitors- biochemicals that control pathogens & can raise phenolic content [28],
- aquaponics- hydroponics is the new technique advanced now including high/ similar metabolite content as in the land farm [29].

Aquaponics is high cost and high-tech, mechanized farming unsuited for India, where agri-employment in vast rural areas is a challenge. So agro-forestry using the above quality based options can provide sustainable livelihood option for millions, using “analog forestry” strategy [14].

On farm organic inputs, beekeeping, are commonly tested natural farming techniques and can improve the export potential due to low/no-chemical residue [30]. Elicitors is a novel technique i.e. agrochemicals primarily designed to improve resistance to plant pathogens [28]. Although elicitors do not kill pathogens, they trigger plant defense mechanisms, and increase the levels of phenolic compounds. Variety of such agro-techniques can improve the herbs quality, drug efficacy, brand value and market share in future as wild harvest potential is limited [31]

and conservation areas cannot be exploited [32]. Various mechanisms to enhance the polyphenol content in Onion in Europe, for instance [33]. Potassium is a vital soil nutrient input to enhance the crop polyphenol content [34] and its supply through ash or microbial inputs (mycorrhiza) improves Curcumin content in Turmeric [35] besides due to the metabolic stress in the lateritic soil. Customer education and general publicity of health benefits of herbs and natural farming techniques is necessary.

Medicinal plants cultivation takes place in backward, poor, uncompetitive regions, where the tribal community income demand is low. Agro-forestry model is promoted here by industries like Dabur co. to farm Dashmula (10 roots) species which are threatened, for sustainability. Corporate social responsibility (CSR) programs can support such triple bottom-line projects (environment, equity and economy) in future. Dabur already has huge cultivation program of both lowland herbs e.g. Tulsi (in Uttar Pradesh state) & Shankhpushpi (Rajasthan state). Other corporate such as Emami, Himalaya Drug. Co. Ltd., Natural Remedies pvt. Ltd. also have started cultivation programs. Chemical inputs are discouraged in medicinal plants farming to protect consumer’s health so this can encourage regenerative agriculture techniques enabling natural farming. It is a step towards net zero carbon emission also [36]. Bioactive ingredients from natural herbs preferred due to their better efficacy or economy globally than synthetic manufacturing with star molecules such as Artemisinin for treating Malaria, Placitaxel and Vincastine for Cancer [37,38] which endorses the future growth in the global trade in medicinal plants.

Conclusions

Medicinal Plants trade grew by nearly 100% in the past decade in India mainly due to the increased use of the cultivated herbs such as Mint, Holy Basil, Indian Ginseng and spices. The raw drug trade is over 0.5 million ton/year and cultivated species stock comprises by nearly 50%. Nearly 200 i.e. 25% of the highly traded species (800 nos.) face extinction risk due to the overharvest. Growing trade and export of herbs from India required higher cultivation focus for sustainability and consumer health protection. For ensuring quality natural farming strategy and various eco-agri-techniques are suggested viz. a) varietal breeding, b) organic inputs, c) mycorrhiza/ bio-fertilizers, d) micro-nutrients, e) cultural/ agronomic practices f) elicitors. This can both improve the herbs potency and avoid chemical residues and its ill effects, enable exports. The government can invest widely in the natural farming (NF) techniques and labeling the ingredient content, safety parameters with industry partnership to cultivate herbs and spice species in global demand such as Mint, Oregano, Rosemary besides Indian famous herbs such as Holy basil & Indian Ginseng.

More efforts on publicity and customer education on health benefits of herbs and natural farming are needed. Patanjali co. increased market share 100 time to cross \$ 1 billion/ year in 10 years by educating the customer new health concepts such as “transfat” in the routine refined flours (“maida” in vernacular) biscuits to push its own “atta” i.e. whole wheat Biscuits (<https://patanjaliayurvedlimited.net>).

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Conflicts of Interest

We declare that there are no conflicts of interest.

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