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## Significance of phytogenic feed additives in poultry production

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In recent years, the poultry industry has witnessed a paradigm shift in its approach towards enhancing productivity, ensuring animal welfare, and meeting consumer demands.

Poultry production encompasses various sectors including broiler (meat) production, layer (egg) production, and turkey production, each with its unique set of challenges and requirements. Broiler production, for instance, focuses on efficiently converting feed into meat while ensuring rapid growth rates and high meat yields. Layer production, on the other hand, revolves around maximizing egg production while prioritizing egg quality, shell strength, and welfare standards. Turkeys present their own challenges, often requiring specialized management practices to optimize growth, minimize stress, and ensure meat quality.

### Role of feed additive in poultry production

Feed additives play a crucial role in modern poultry production systems, serving diverse functions aimed at improving performance, health, and overall profitability. These additives encompass a broad range of compounds, including antibiotics, enzymes, probiotics, prebiotics, organic acids, and phytogenic products. Historically, antibiotics have been extensively used in poultry feeds to promote growth, prevent disease, and improve feed efficiency. However, concerns regarding antimicrobial resistance and consumer preferences for antibiotic-free poultry products have prompted a reevaluation of antibiotic usage in animal agriculture.

After the ban of antibiotics used as feed additives in poultry feed by European union since 2006, several countries are on the way either to ban / or restrict its usages to combat the challenges of antimicrobial resistance. Albeit, several alternatives are suggested to mitigate the challenges of unabated AMR, nevertheless, application of phytogenic is receiving greater attention because these are safe, lower cost, higher efficacy, precise activity, environment and consumer friendly coupled with residue free and hold status of GRAS - generally recognized as safe.

### Phytogenic feed additives

Phytogenic are mainly a group of natural growth promoters or non- antibiotics growth promoters used as feed additives, derived from herbs, spices or other plant parts. Phytogenic feed additives having bioactive constituents like flavonoids, phenols, glycosides, coumarins, saponins, terpenes and alkaloids, which are mainly plant secondary metabolites synthesized by

plants to interact with biotic and abiotic environments, playing roles in plant defense, growth and development.

Table 1: Phytogetic plants, its bioactive components and functions for poultry

Sl. No.	Phytogetic plants	Bioactive Components	Functions
1.	Anise	Carvacrol, Thymol	Increase digestive secretion, Anti-bacterial effect
2.	Black pepper	Piperine, capsaicin	Carminative, Antioxidant, Antibacterial
3.	Cinnamon	Cinnamic acid and cinnamaldehyde	Antioxidant
4.	Celery	Apiin, apigenin	Natural antioxidants (especially vitamins, flavonoids and unsaturated fatty acids)
5.	Capsicum	Capsaicin	Digestive stimulant
6.	Curry leaves	Carbazole alkaloid	Antioxidant
7.	Ginger	Zingerone	Gastric stimulant
8.	Haldi	Curcumin	Increase egg production, egg mass, Feed intake
9.	Lemongrass		Antioxidant activity
10.	Mentha arvensis	Menthol, isomenthol	Increase feed intake, egg production and egg weight
11.	Nutmeg	Essential oil	Carminative, Antioxidant, Antibacterial
12.	Oregano EO	Thymol	Increase final BW, Feed intake
13.	Sage	Cineol	Digestive stimulant, antiseptic, antioxidant
14.	Tea tree leaves	Terpinen, Carvacrol	Decrease FCR & increase egg production
15.	Thyme	Thymol, Carvacrol	Increase egg production

Consequently, poultry producers have increasingly turned to alternative feed additives, such as phytogetic products, to fill the void left by antibiotics. Phytogetic products, derived from various plant sources including herbs, spices, essential oils, and botanical extracts, offer a natural and sustainable solution for enhancing poultry performance and health. With their complex mixture of bioactive compounds, phytogetic products exert multifaceted effects on the gastrointestinal tract, immune system, and microbial populations within the bird, leading to improved nutrient utilization, disease resistance, and overall well-being.

### Roles of phytogetic products in poultry production

Phytogetic products have garnered considerable attention in the poultry industry due to their potential to address multiple challenges facing poultry producers, ranging from growth promotion and feed efficiency to disease control and environmental sustainability. Unlike conventional feed additives, which often target specific pathways or organisms, phytogetic products exert broad-spectrum effects through their diverse array of bioactive constituents.

Phytogenic products, derived from herbs, spices, and other plant materials, offer a natural alternative to traditional feed additives, showcasing significant promise in promoting growth performance, improving feed efficiency, enhancing immune response, and mitigating environmental challenges. Understanding the significance of phytogenic products in the context of the poultry industry requires a comprehensive exploration of various aspects including their mechanisms of action, benefits, and implications for poultry producers and consumers alike.



**Fig 1: Different modes of action of phytogenic feed additive on poultry production**

### 1. Emulating digestive efficiency:

Phytogenic feed additives contain a plethora of bioactive compounds such as essential oils, saponins, and flavonoids, which stimulate the secretion of digestive enzymes in the gastrointestinal tract of poultry. These enzymes, including amylase, protease, and lipase, play crucial roles in breaking down complex carbohydrates, proteins, and lipids present in the feed into smaller, more absorbable molecules. By enhancing the activity of digestive enzymes, phytogenic additives improve the overall digestibility of feed ingredients, ensuring that nutrients are efficiently absorbed and utilized by the bird's body. This results in enhanced growth performance, improved feed conversion ratios, and ultimately, better economic returns for poultry producers.

### 2. Enhancing feed palatability:

Certain components of phytogenic additives, such as aromatic essential oils derived from herbs and spices, impart desirable flavors and odors to the feed, making it more palatable to poultry. These natural flavors stimulate the bird's appetite and encourage increased feed intake, which is particularly beneficial in young chicks or during periods of stress when feed consumption may be compromised. By promoting higher feed intake, phytogenic additives

support optimal growth rates and feed efficiency, leading to improved production outcomes in broilers, layers, and turkeys.

### 3. Modulating gut microbiota:

Phytogenic additives exert prebiotic and antimicrobial effects in the gastrointestinal tract, influencing the composition and activity of the gut microbiota. Certain bioactive compounds present in phytogenic additives, such as tannins, flavonoids, and phenolic acids, selectively promote the growth of beneficial bacteria such as *Lactobacillus* and *Bifidobacterium*, while inhibiting the proliferation of pathogenic bacteria such as *Salmonella* and *Clostridium*. This balanced microbial ecosystem enhances gut health, reduces the incidence of digestive disorders such as necrotic enteritis and coccidiosis, and improves overall nutrient absorption and immune function in poultry.

### 4. Boosting immune function:

Phytogenic additives contain phytochemicals with immunomodulatory properties that stimulate the bird's innate immune system, enhancing its ability to defend against infectious diseases. Components such as polyphenols, terpenoids, and polysaccharides found in phytogenic additives stimulate the production of cytokines, immunoglobulins, and other immune mediators, which play crucial roles in mounting an effective immune response against pathogens. By strengthening immune function, phytogenic additives reduce the susceptibility of poultry to infectious diseases, thereby decreasing the need for antibiotic interventions and promoting overall flock health and welfare.

### 5. Alleviating stress:

The adaptogenic properties of phytogenic additives help poultry cope with various stressors encountered during production, including heat stress, transportation, and social stressors within the flock. Bioactive compounds such as adaptogens and antioxidants found in phytogenic additives help mitigate the negative effects of stress on growth performance, immune function, and overall well-being in poultry. By reducing stress-induced physiological responses, phytogenic additives support optimal production outcomes and enhance the resilience of poultry in challenging environmental conditions.

### 6. Improving meat and egg Quality:

Phytogenic additives have been shown to positively influence the quality attributes of poultry products, including meat flavor, texture, and shelf life, as well as egg quality parameters such as shell strength and yolk color. Components such as essential oils and flavonoids present in phytogenic additives impart desirable sensory characteristics to poultry products, enhancing consumer satisfaction and market competitiveness. Additionally, certain bioactive compounds in phytogenic additives, such as carotenoids, contribute to the vibrant coloration of egg yolks, further enhancing their visual appeal and nutritional value.

### 7. Reducing environmental impact:

Phytogenic additives offer a natural and sustainable alternative to synthetic feed additives, contributing to environmentally friendly poultry production practices. By reducing the reliance on antibiotics and synthetic growth promoters, phytogenic additives help mitigate the risk of antimicrobial resistance and minimize environmental contamination from antibiotic

residues in poultry products and waste. This aligns with consumer preferences for sustainably produced poultry products and supports the long-term viability of poultry production systems.

**Conclusion:**

Phytogenic feed additives play a multifaceted role in poultry production, offering a natural and sustainable solution for optimizing performance, health, and environmental stewardship across the poultry value chain. By addressing key challenges such as digestive inefficiency, immune suppression, and environmental concerns, phytogenic additives contribute to the overall efficiency, profitability, and sustainability of poultry production systems.