

THE ROLE OF CALCIUM, COMMON NETTLE AND MARIGOLD (CALENDULA OFFICINALIS) SUPPLEMENTATION AS BOOSTER FOR LAYING HENS IN INTENSIVE POULTRY FARMING

Increasing demand of poultry products led to tendency to boost bird's performances. An excessive boosting can result in serious effects on birds health; decreased production period, altered physiological state, compromised immune system performances. Regarding laying hens production, egg quality is a main topic: in the latest deposition phases, the shell's quality tends to decrease, and it's quite common to see this in association with a loss of hen's bones consistency, due to demineralization, which may also lead to bones fractures. Therefore, the supplementation through a correct and balanced feeding plays a key role in order to minimize and avoid such problems. Many different nutrients, from minerals to vitamins, have shown as essential in order to guarantee and promote optimal hens wellbeing together with increased performances. Common Nettle (*Urtica dioica*) supplementation can improve immune response in hens challenged by the laying stressful phase while improving egg overall quality and shell thickness, contributing to decrease breakage losses. In different in vivo trials, nettle supplementation lead to increased yolk color and tocopherol content, improved overall egg quality including shell thickness, improved hens blood parameter and antibody titre (1,2,3). Among herbal extracts, Marigold (*Calendula Officinalis*) showed promising results as hens food supplement due to its content in xanthophylls: Marigold flower and product derived from flower extraction (MFE) is a natural source of carotenoids, specially xanthophylls (17): in vivo study showed the highest hen-day egg production ($P = 0.005$) and egg mass production ($P = 0.010$) in hens supplemented with MFE, together with increased yellowness, redness, ratio of redness/yellowness ($P < 0.001$), and decreased for lightness ($P = 0.036$). Moreover, the lutein and zeaxanthin content in yolk increased (4,5). In another in vivo study, the effects of diet supplemented with marigold flower powder on egg yolk fatty acid composition

and egg quality parameters was determined. Laying performance, egg quality parameters, and feed intake were also evaluated. Yolk color scores in the group fed with marigold-supplemented diet were found greater than control. Diet including marigold increased total saturated fatty acids (SFA) and decreased monounsaturated fatty acids (MUFA) in the egg yolk (6). Eggshell mineral originates from the accumulation of flat disk-shaped amorphous calcium carbonate (ACC) particles on specific organic sites on the eggshell membrane, which are rich in proteins and sulfated proteoglycans (10). Therefore, among minerals, calcium carbonate, zinc sulphate and copper sulphate are important for laying hens health and performances (11): they must be correctly balanced in order to avoid feed intake decrease or absorption problems.

Improvement on egg shell quality and hens performance were recorded with different levels of calcium supplementation (7, 8) but calcium requirement for laying hens need updated information as the genetic changes every year. Calcium levels are usually increased when laying hens mature in age. Field trials results suggested that a higher daily calcium intake (3.94-4.89 g/hen/day for maximum shell quality) should be recommended for aged laying hens (9). Further field investigation demonstrated how Zinc, Copper and vitamin A supplementation would produce best productive and reproductive performances (12,13,14).

Vitamin D3 plays a key role in mineralization process: is absorbed from birds intestine and is transported to the liver and then the kidney, where it becomes an active hormonal compound called calcitriol, the main controller of body calcium levels (18). Vitamin D3 supplementation brought evidences of increased eggshell quality, together with increased yolk antioxidant activity and excellent hatchability (15,16).



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