Greenhouse experiments showed that moderately reducing nutrient solution supply by 20%~40% during the 6 days before harvest could improve nitrogen recovery efficiency and increase capsaicinoid and flavor compound content, while maintaining yield (Wang et al., 2022).

5.2 Split application versus basal application

Split nitrogen application helps synchronize fertilizer supply with crop uptake, reduces leaching losses, and often maintains or even increases yield at equal or lower nitrogen levels. Under saline-alkaline conditions, applying 150 kg•N•ha^{-1} (N150) as ammonium nitrate through multiple fertigation events at key stages (vegetative growth, flowering, and harvesting) significantly improved plant growth, fruit number, and capsaicin content, especially when combined with effective microorganisms (Abdelkhalik et al., 2023).

In chili cultivation with polyethylene mulching in Indonesia, both split soil fertilization and drip fertigation performed better than single basal application, resulting in higher total and marketable yields (Susila and Oktavia, 2020).

Field studies comparing different fertilizer ratios (basal:topdressing = 100:0, 50:50, 30:70) showed that the 50:50 treatment, combined with livestock manure and chemical fertilizers, improved nitrogen use efficiency (NUE) while maintaining yield. In contrast, excessive basal nitrogen (100:0) increased early soil nitrate levels but did not improve yield (Lee et al., 2022).

5.3 Controlled-release fertilizers and fertigation technology

In systems without drip irrigation, controlled-release nitrogen fertilizers can partly replace the effect of split applications. In mulched sweet pepper production, pre-plant application of sulfur-coated urea and polymer-coated urea (90~180 kg•N•ha^{-1}) produced yields comparable to or higher than those achieved with 12 weekly fertigation events, with higher NUE at lower nitrogen rates, especially in coarse sandy soils (Reyes et al., 2008).

In fertigation-based chili production, appropriate fertilization intervals and frequency (e.g., every 3 days, 1~3 times per day) can promote plant growth and increase fruit number, although the effect on individual fruit weight is relatively small (Padmini et al., 2023).

Open-field studies indicate that optimizing the ratio between basal fertilizer and fertigation—by combining slow-release fertilizers or organic-inorganic compound fertilizers with partial fertigation—can maintain yield while reducing soil nitrate accumulation. In addition, short-term reduction of water and fertilizer supply before harvest can improve fruit quality and nutrient harvest index without reducing yield.

5.4 Synergistic management with other nutrients (P, K, and micronutrients)

Proper nitrogen management needs to be coordinated with phosphorus (P), potassium (K), and micronutrients to fully realize yield potential and capsaicinoid accumulation. Application of 75%~100% recommended NPK fertilizer significantly enhanced vegetative growth, yield components, and capsaicin content. The best performance was observed with 100% NPK combined with nano-micronutrients (Fe, Zn, B, Mn, Cu, Mo), which produced significantly higher yield and capsaicin content than the unfertilized control (Ahmed and Abdelkader, 2020).

In semi-arid sandy soils, combining soil fertilization with foliar application (e.g., 50% soil + 50% foliar) significantly increased leaf area, fruit number, fruit weight, and plant NPK nutritional status compared to soil fertilization alone (Hemida et al., 2023).

Compared with unfertilized treatments, integrated use of chemical and organic fertilizers in an NPK system significantly improved yield and capsaicin content, although responses varied among cultivars. Under low phosphorus conditions, mycorrhizal inoculation enhanced N, P, K, and capsaicin content in chili fruits, indicating that proper phosphorus supply and microbial symbiosis can work together with nitrogen to improve pungency and nutritional quality.