The differences in long-term average yield are also shaped by cropping system and management, rather than species identity alone. In southeast China, a nine-year rotation study found that kidney bean average yield under one rotation system was 7.47% higher than under another when recommended fertilization was used, showing that mean legume yield can shift markedly with system configuration. In another long-term subtropical rotation experiment, rice yield under a rice-faba bean sequence reached 8.73 t·ha^{-1}, 19.1% above the rice-wheat control, indicating that legume inclusion can raise the productivity of the whole system and indirectly alter the comparative value of different legume species within rotations (Yang et al., 2024). Therefore, when comparing average yields among legumes in Zhejiang, it is more appropriate to interpret observed species differences as the joint result of genetic potential, rotation fit, and management compatibility.

4.2 Annual variation trends

Annual yield variation is a core part of stability analysis because mean yield alone can mask large year-to-year fluctuations. A long-term experiment in southeast China showed that crop yield varied greatly over time under the influence of climate, precipitation, and other environmental factors, and that the yield trends of kidney bean and mustard differed significantly between rotation treatments over nine years (Zhang et al., 2022). Evidence from broader crop-yield analysis in China likewise showed that crop yields generally increased over time at the national scale, but with strong provincial differences in annual growth rates, indicating that temporal yield trajectories are rarely uniform across regions or crop types. Applied to Zhejiang legumes, this means annual variation should be evaluated not only by whether yield rises or falls, but also by the rate, direction, and consistency of change under different production environments.

Different legume crops also appear to differ in the magnitude of their interannual fluctuations. In species-comparison research, faba bean maintained relatively high yields but varied strongly among years, and one low-rainfall year caused a clear yield reduction, showing its sensitivity to annual weather anomalies (Jarecki and Migut, 2022). Broader evidence suggests that temporal instability in legumes is not necessarily extreme relative to other spring crops: across long-term European experiments, grain legumes showed 30% temporal instability, only slightly above spring cereals at 27%, and were judged as reliable as other spring-sown crops when assessed with scale-adjusted methods. For Zhejiang, annual yield trend analysis should therefore pay particular attention to whether specific legumes combine acceptable mean yield with limited fluctuation under variable rainfall, temperature, and seasonal light conditions.

4.3 Ecological-region performance

Yield performance across ecological regions differs because legume crops respond strongly to local climate, soil, and resource conditions. A large soybean dataset from China showed grain yield ranging from 1.4 to 4.5 t·ha^{-1} across 146 locations, with the main climatic drivers shifting by region: temperature dominated in cool high-latitude areas, whereas radiation was more important in hot, humid low-latitude regions (Wu et al., 2023). Complementary evidence from explainable AI analysis across nine grain legumes found that different species respond differently to environmental factors, with cowpea showing higher productivity at elevated latitudes, while garden pea and faba bean were especially sensitive to soil moisture, organic matter, and soil type. This supports the expectation that legumes in Zhejiang will show clear regional differentiation between plains, coastal zones, and hilly uplands.

Regional comparison studies further show that legume-related yield outcomes often improve most in areas with stronger resource constraints or favorable hydrothermal conditions. A national meta-analysis found that legume green manure increased grain-crop yields in most regions of China, with the largest increase in Northeast China, and that benefits were greatest where annual precipitation exceeded 600 mm and annual mean temperature exceeded 10 °C (Liang et al., 2022). Similarly, a meta-analysis of soybean/maize intercropping concluded that the Yangtze River Basin was the most suitable region for adoption and that the system was especially beneficial in areas with limited agricultural resources. Since Zhejiang lies within the broader Yangtze River agricultural zone and has humid subtropical conditions, these results suggest that regional differences in yield performance among legume crops in the province are likely to reflect both ecological suitability and the extent to which each species