Soil degradation and nutrient depletion are significant challenges facing modern agriculture, exacerbated by traditional farming practices and the excessive use of chemical fertilizers. These issues contribute to declining soil fertility, reduced crop yields, and long-term environmental degradation. In response, there is a growing need for sustainable agricultural practices that enhance soil health and reduce dependence on synthetic inputs. The overall aim of this study is to develop nutrient-rich compost by integrating cow dung, plant litter, fodder waste, and rock phosphate, thereby improving soil fertility and supporting sustainable agriculture. The study employed a quantitative research design, utilizing an L_9 (3^4) orthogonal experiment to optimize the combination of composting materials. The physio-chemical parameters and nutrient contents of all the compost treatments were monitored throughout the composting process. The results indicated that the addition of cow dung, plant litter, and rock phosphate significantly enhanced the nutrient content of the compost. For instance, the highest nitrogen concentration was 41.08 g/kg in the treatment T4 with 30% plant litter and 25% rock phosphate while phosphorus levels peaked at 0.84 g/kg in the treatment T2 with 25% fodder waste and 25% rock phosphate. The Compost Quality Index (CQI) ranged from 2.14 to 6.80, with the highest value indicating "Very Good" compost quality. In conclusion, this study demonstrates that the strategic combination of cow dung, plant litter, and rock phosphate can produce high-quality compost that supports sustainable farming practices. It is recommended that further research explore the long-term effects of this compost on crop yields and soil health across different agricultural settings.