Summer cover crops can improve internal nutrient cycling and soil health in Florida agroecosystems while increasing crop yield, with mixtures potentially providing more benefits to growers than monocultures. In June 2018, we established a two-year experiment in Gainesville (Florida) comparing the effects of five summer cover crop treatments and a weedy fallow (WF) on cover crop biomass production, soil nutrient cycling, and bell pepper yields. Cover crop treatments included monocultures of sunn hemp (SH) or sorghum sudangrass (SH), a SH – SSG mixture, a SH – SSG – buckwheat mixture, and a SH – SSG – buckwheat – cowpea – sunflower mixture. Cover crops were planted in June and terminated after 8 weeks. Bell peppers were grown subsequently and fertilized with 149 kg N ha\(^{-1}\) for all cover crop treatments, whereas WF plots were split into two N treatments: 149 and 224 kg N ha\(^{-1}\) treatments. Summer cover crops had large N uptake rates, especially in mixtures containing both sunn hemp and sorghum sudangrass. However, summer cover crops did not increase soil N availability and yields, most likely because the transfer of cover crop N to the subsequent cash crop was limited. The two species mixture produced greater biomass than the monocultures in both years, with the exception of similar biomass in the sunn hemp monoculture and the two species mixture in 2018. Partial N budgets showed large N surpluses, although all cover crops showed good potential to scavenge residual soil N. Overall, as cover crop N transfer in this vegetable system seemed low, N taken up by cover crop biomass was likely susceptible to substantial losses.

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