Comparing Stacked and Alternate-Year Cropping Systems In a Semiarid Environment

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Diversification of wheat-fallow systems can improve economic and environmental sustainability of semi-arid cropping systems, but the influence of rotation type and management level are little known. We conducted a study from 2005 through 2011 comparing two sets of crops in stacked and alternate-year rotations under conventional and ecological management levels. Crop sets were durum-canola-pea and durum-flax-pea. Continuous durum was included as a control. Conventional management included preplant tillage with a field cultivator, broadcast urea, standard seeding rates, and short durum residue height at harvest. Ecological management included zero tillage, banded urea at planting, greater seeding rates, and tall durum residue height at harvest. Rotations differed for stand and tiller density, and seed head-1, but differences were not consistently related to rotation type (Table 2). The greater seeding rate for ecologically managed durum resulted in denser crop stand and reproductive tillers, however, it did not result in decreased weed biomass (Table 2). Interactions of rotation with management (Table 3) and year (Table 4) were significant for durum yield. Durum yield was greater for six of six years under ecological management than under conventional management. When differences existed, durum under ecological management was taller and had more reproductive tillers, but fewer seed head-1, than durum under conventional management. Rotation type and management inconsistently influenced weed biomass. Continuous durum had the greatest mean weed biomass at harvest (Table 2). Weed biomass in durum did not differ between conventional and ecological management systems in four of six years (Table 4). Durum was severely damaged following application of bromoxynil-MCPA herbicides during an unusually hot and humid day in 2007 and results for that year are not presented.

When systems are compared across all crop phases, conventional and ecological management provided similar grain yield, crop biomass, harvest index, and weed biomass (Table 5). Continuous durum had the greatest grain yield. Stacked- and alternate-year rotations with canola had higher grain yield than the stacked rotation that included flax; the alternate year rotation with flax was intermediate to all other rotations. Weed biomass was lower in rotations that included canola than rotations that included flax, regardless of rotation type (Table 5). Harvest index was not influenced by rotation type. Economic analyses will provide additional information necessary for improved farmer decision making with these production systems.