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Jet fuel from 18 cool-season oilseed feedstocks in a semi-arid environment

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Renewable jet fuel feedstocks can potentially offset the demand for petroleum based transportation resources, diversify cropping systems, and provide numerous ecosystem services . However, identifying suitable feedstock supplies remains a primary constraint to adoption. A 4-yr, multi-site experiment initiated in fall 2012 investigated the yield potential of six winter- and twelve spring-types of cool-season oilseed feedstocks. Sidney, MT (250 mm annual growing season precipitation) was one of eight sites in the western USA with others in Colorado, Idaho, Iowa, Minnesota, North Dakota, Oregon, and Texas. Winter types of Camelina sativa (1), Brassica napus (4), and B. rapa (1) were planted in mid-September, while spring types of Camelina sativa (1), B. napus (4), B. rapa (1), B. juncea (2), B. carinata (2), and Sinapis alba (2) were planted in early to late April. Seeding rates varied by entry and were between 4 to 11 kg/ha. All plots were under no-till management. Plots were 3 by 9 m with each treatment (oilseed entry) replicated four times. Camelina 'Joelle' was the only fall-seeded entry that survived winters with little to no snow cover on plots and where minimum air temperature reached -32°C. Stands of 'Joelle' in the spring of all years were excellent. 'Joelle' plots were typically harvested in July, while spring types were harvested 2-6 weeks later. Severe hailstorms during the late growing seasons of 2013 and 2015 resulted in up to 95% seed loss, preventing normal seed yield harvest of spring types. The B. carinata and spring camelina were the least and most susceptible to hail damage during plant maturity, respectively. 'Joelle' winter camelina was harvested before the severe weather in both years, showing the benefit of an early maturing crop in regions prone to late season hail. Overall, camelina was the only winter type that showed potential as an oilseed feedstock due to its superior winter hardiness. For spring types, B. napus, Camelina sativa, and B. carinata showed the greatest potential. Seed yield, excluding the five winter types that succumbed every year to winter kill, ranged from about 200 to 2000 kg/ha, with B. napus hybrids (1900 kg/ha), winter and spring camelina (1700 kg/ha), and B. carinata (1300 kg/ha) showing the greatest feedstock potential. Other measurements taken, but not reported included crop phenology, canopy spectral reflectance, leaf area, leaf area index, canopy temperature, soil water use, crop biomass, yield components, seed oil%, seed fatty acid composition, and drought resistance. Overall, camelina was the only winter type in addition to spring types of B. napus, B. carinata, and camelina that showed good potential for jet fuel feedstocks in the semi-arid northern Great Plains, USA.