Abstract

There has been keen interest in camelina (Camelina sativa L. Crantz) in recent years due to the unique fatty acid composition of the seed oil for human and animal consumption and, more importantly, the value of the seed oil to provide “green energy” to fuel commercial and military aircraft. The objective of our research was to evaluate several planting dates and two planting methods for camelina stand establishment and seed yield. Field experiments were conducted for three years at four distinct rainfed agro-environments in the Pacific Northwest, USA. Average crop-year precipitation at the sites during the three years was: Lind WA, 9.0 inches; Pendleton OR, 16.6 inches; Moscow ID (one year only), 29.9 inches; and Corvallis OR, 39.1 inches. Camelina was planted on an average of five dates at each site (n=55) from early October to mid April at a rate of 5 lbs/acre by either drilling seed at a shallow depth or broadcasting seed on the soil surface. Although camelina has excellent cold hardiness, the best plant stands were achieved with late-winter and early-spring plantings. Four divergent planting date yield responses across sites were: no yield differences at Lind; increased yield with later planting dates at Pendleton; reduced yield with later plantings at Moscow (one year data) and; a curvilinear response at Corvallis with the lowest yields from plantings in early fall and those after March 1 and highest yields from late-fall and mid-winter plantings. Both drilling and broadcast were effective for planting camelina with no overall advantage of either method. Seed yields ranged from < 100 lbs/acre during an extreme drought year at Lind to 2590 lbs/acre at Moscow. Averaged across four Pacific Northwest agro-environments in this study, we recommend: (i) late February-early March as the best overall planting date because of optimum stands and seed yield and having effective control of winter-annual broadleaf weeds with herbicide applied just prior to planting; and (ii) the broadcast method of planting as it generally equaled or slightly exceeded drilling for plant stand establishment and seed yield and can be accomplished more quickly at less expense.

Introduction

Camelina is a short-season annual oil-seed crop in the Brassicaceae family produced for the oil in Europe for 3000 years. Camelina is newly introduced to crop production in the USA and Canada with most production in the last five years in Montana and North Dakota, a region with summer-dominant rainfall. Oil content in camelina seed can range from 38 to 43% and seed protein content from 27 to 32%. High concentrations of omega-3 fatty acids in the oil makes camelina an attractive food oil crop. Camelina meal has been approved and used on a limited basis for beef cattle and chickens. The oil can also be used as a feedstock for biodiesel and more recently has been under investigation for aviation fuel. Jet fuel derived from camelina oil has undergone extensive testing by commercial airlines and the US military. Results show that camelina-based hydrotreated jet fuel meets all jet engine performance expectations and significantly reduces greenhouse gas emissions.

Materials and methods

A 3-year field experiment was conducted during the 2008, 2009, and 2010 crop years at five sites in the Pacific Northwest (PNW) to determine the most suitable planting date(s) and method of planting for rainfed camelina production. Field sites, representing each of the four major rainfed production zones, were located at Lind WA, Pendleton OR, Moscow ID, and Corvallis OR.

Experimental design was a split plot in randomized block arrangement with planting date as the main plot and planting method as subplots. All treatments were replicated four times. The camelina cultivar ‘Calena’ was used at all locations. Nitrogen fertilizer was applied at all sites at moderate rates based on soil tests. In-crop post-emergence grass weed herbicides, either Poast™ or Assure II™, were successfully used to control downy brome (Bromus tectorum L.), volunteer wheat and other grass weeds.

Planting dates at all sites were intended for the middle of October, November, December, January, February, early March, and the “last feasible date” at each respective site. Seed was planted with a drill at a shallow (< 0.5-inch) depth and by broadcasting on all planting dates.

Results

Our data from 55 planting dates using two planting methods over 10 site years in the PNW indicate: Camelina can be successfully sown over a wide range of planting dates from early fall to early spring (Figure 1). Fall-planted camelina has excellent cold tolerance, similar to winter wheat. However, primarily due to the lack of in-crop herbicides to control winter-annual broadleaf weeds, we recommend that farmers apply glyphosate or other non-soil residual burn-down herbicide in mid-to-late February to control weeds, followed by late February-early March camelina planting.

Both drilling and broadcasting were effective methods for planting camelina. At Lind, there was no overall advantage of either method. There were three occasions at Lind; however, where broadcast stands and subsequent seed yield were significantly reduced compared to drilling when no precipitation occurred for several weeks after planting. At Pendleton, seed yield from broadcast planting was superior to drilling for fall and early-to-mid winter planting dates. There were no consistent differences in seed yield as affected by planting method at Moscow and Corvallis. From an economic standpoint, we recommend farmers use broadcast planting combined with some form of light incorporation of seed into the soil.

Although not part of this experiment, farmers need to be mindful that camelina produces relatively little residue. With heavy tillage, soil erosion may be a problem during or after camelina production. To reduce the potential for soil erosion, we recommend that (i) camelina be planted directly into the standing and undisturbed stubble of the previous crop (i.e., no tillage), and (ii) minimal or no tillage be conducted after camelina seed harvest and before planting the subsequent crop. This is especially important if a year-long fallow period is scheduled in the rotation after camelina seed harvest.

Figure 1. The relationship of camelina seed yield and planting date using both direct drilled and broadcast methods at four locations over three years in the Pacific Northwest.

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