

The effects of time of application of nitrogen on seed yield , efficiency of N fertilizer use and apparent N fertilizer recovery of Russian wildrye [*Psathyrostachys juncea* (Fisch .)Nevski]

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Introduction Availability of nitrogen (N) is considered to be a major determinant of grass seed yield . Nitrogen fertilizer application rate and the timing of its application are the two major concerns of research on the fertilizer-N requirement of grass seed crops . No information is available regarding the effects of split-nitrogen application on Russian Wildrye [*Psathyrostachys juncea* (Fisch .)Nevski]seed production . Our objective was to determine the effect of rate and timing of N fertilizer application on Russian Wildrye seed yield and on the efficiency of nitrogen input .

Materials and methods The field experiment was conducted at China Agricultural University Forage Seed Production Research Site (39°37'N , 98°30'E , altitude 1480 m) located in Jiuquan , Gansu , China . A Russian wildrye cv . Bozoisky seed crop was established with 45 cm row space and seeding rate of 15 .0 kg/ha in the spring of 2002 . Initial chemical characteristics of the soil (0-30 cm) tested before the fertilizer-N application in the early autumn of 2005 were : pH 8 .0 , organic matter 0 .84g kg⁻¹ dry matter , available N 6 .6 mg kg⁻¹ , available P 42 .9 mg kg⁻¹ (Olsen method) , available K 175 .6 mg kg⁻¹ (NH₄Ac) , total salt 12 .6 g kg⁻¹ . The experiment utilized a randomized complete block design with four replications . Each replication had 7 treatments . Individual plot size was 5 .0 m by 6 .0 m . Application rates in 2006 were 0 , 150 , or 300 kg N ha⁻¹ . These were 0 , 0 , or 250 kg N ha⁻¹ in 2007 . The three application times for both years were : (1) Autumn (20 August 2005 and 17 August 2006) ; (2) Late-winter (22 October 2005 and 6 October 2006) ; (3) Early spring (28 March 2006 and 12 March 2007) . Application rates above 100 kg N ha⁻¹ at any one time were split 100 :50 , 100 :100 ; or 100 :100 :50 , 7 days apart . N fertilizer use efficiency (NUE) and apparent N fertilizer recovery (ANR) were calculated according to Cookson et al . (1999) .

Table 1 Effects of nitrogen fertilizer treatment on Russian wildrye seed yield , N fertilizer use efficiency (NUE) and apparent N fertilizer recovery (ANR) in 2006 .

Treatment*	Seed yield (kg ha ⁻¹)	NUE	ANR (%)
0+0+0	727e**	—	—
150+0+0	1342bc	4 .10bc	20 .1b
50+50+50	1553b	5 .50ba	33 .2a
50+0+100	1332bc	4 .03bc	34 .7a
0+50+100	1266c	3 .59c	38 .4a
0+0+150	966d	1 .59d	37 .9a
50+100+150	2524a	5 .99a	40 .5a
LSD _{0.05}	231	1 .63	10 .0

Table 2 Effects of nitrogen fertilizer treatment on Russian wildrye seed yield , N fertilizer use efficiency (NUE) and apparent N fertilizer recovery (ANR) in 2007 .

Treatment*	Seed yield (kg ha ⁻¹)	NUE	ANR (%)
0+0+0	524d	—	—
250+0+0	973bc	3 .40dc	7 .7c
150+50+50	1271ba	5 .54a	21 .0b
50+100+100	1425a	5 .38ba	30 .3a
50+50+150	1130ba	4 .25bac	22 .5ba
50+0+200	1059bac	4 .82ba	23 .1ba
0+0+250	701dc	2 .25d	25 .9ba
LSD _{0.05}	374	1 .48	8 .3

* Treatments , N rates (kg N ha⁻¹) in autumn + late-winter+ early spring . ** Different letters in the same column means significantly different (p<0 .05) according to the Duncan's Multiple Range Test .

Results In 2006 , seed yield increased significantly (p<0 .05) as the rate of N fertilizer applied increased to a maximum of 300 kg N ha⁻¹ N ; fertilizer applied in autumn , later winter and spring (50+50+50) significantly (p<0 .05) increased seed yield when compared with late winter and spring N fertilizer (0+50+100) and spring N fertilizer alone (0+0+150) (Table 1) . In 2007 , when N fertilizer was applied in autumn , late winter and spring (50+100+100) , seed yield was significantly (p<0 .05) increased compared with autumn N fertilizer (250+0+0) and spring N fertilizer alone (0+0+250) (Table 2) . In both years , NUE and ANR maximized when N fertilizer was applied in autumn , late-winter and spring . Autumn N fertilizer alone had the lowest ANR and spring N fertilizer alone had the lowest NUE .

Conclusion In the west of Gansu , China , seed yield , efficiency of N fertilizer use and apparent N fertilizer recovery in Russian Wildrye seed crop were greatest when N fertilizer was applied at a rate of 50 kg N ha⁻¹ , 100 kg N ha⁻¹ , and 100 or 150 kg N ha⁻¹ in autumn , late winter , and spring , respectively .

Reference

Cookson , W .R . , Rowarth , J .S . , Cameron , K .C . , 1999 . The response of a perennial ryegrass (*Lolium perenne* L .) seed crop to nitrogen fertilizer application in the absence of moisture stress . *Grass and Forage Science* , 55 , 314-325 .