

Optimum Seeding Rate of Perennial Ryegrass for Drill Seeding Method

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ABSTRACT

Four seeding rates of 10, 20, 30 and 40 kg ha⁻¹ were tested for ascertaining optimum seeding rate of perennial ryegrass (*Lolium perenne* L.) for the drill seeding method in the subtropical zone, Muzaffarabad, Azad Kashmir. Seeding was done in 30 cm apart man-operated drills in 1.5 x 1.5 m plots with six drills in each plot. Treatments were replicated three times in a completely randomized design (CRD). After about one and a half year of seeding, plots were harvested, air-dried and weighed out for dry matter production assessment. Treatment means were found not significantly different from one another at five % level of significance but maximum aboveground dry matter production of 1.41 t ha⁻¹ was achieved from the seeding rate of 10 kg ha⁻¹ suggesting that lower seeding rates are more appropriate than the higher ones for the drill seeding method of perennial ryegrass.

Key Words: Determining optimum: Seeding rate; Subtropical zone; Muzaffarabad

INTRODUCTION

The state of Azad Jammu and Kashmir (hereafter will be called "AJK") generally consists of moderate to steep slopes, usually broken by an intricate maze of narrow ravines, gullies, channels, sharp crests and pinnacles resulting from serious erosion of soft geological materials. Because of such topographic features, agriculture is practiced only over 13% of the land area (Butt & Ahmed, 1996). Termizi and Rafique (2001) reported that the rest of the area is classified as demarcated forests (42.62%), culturable waste (2.42%) and un-culturable waste (41.96%). These classified areas are virtually used for livestock grazing. About 2.5 million different kinds of livestock heads graze over these areas (Termizi & Rafique, 2001). The grazable flora of these areas is mainly C₄ type comprising of *Themeda anathera*, *Chrysopogon aucheri*, *C. montanus*, *Poa annua*, *Eragrostis pilosa*, *Pennisetum orientale*, *Aristida cylindrica*, *A. depressa* and *Heteropogon contortus*. These grasses become dry during winter causing shortage of green forage for the livestock. Winter, being severe and long lasting, the shortage of green forage during this part of year, becomes a serious problem for livestock production in AJK. Therefore, introduction of C₃ forage plants in the grazing areas could help a lot to improve production of green forage for the livestock particularly during winter. The earlier studies on plant introduction trials have shown that perennial ryegrass (*Lolium perenne* L.)—a cool-season perennial bunch grass—is well adapted to the climatic conditions of subtropical and wet temperate areas of Azad Kashmir. The high yield potential, fast establishment, suitability for reduced-tillage renovation and use on heavy and waterlogged soils make it an important grass in forage production systems (Hannaway *et al.*, 1999). Furthermore, the high palatability and digestibility make it

highly valued forage for dairy and sheep forage systems.

Among many other factors, proper seeding rate is altogether important in establishing a good forage stand, because number and vigour of newly emerged seedlings and their establishment mainly depend on proper seeding rate. Metcalf (1980) suggested 28 - 39 kg ha⁻¹ seeding rates whereas Ball *et al.* (1991) recommended 22 - 34 kg ha⁻¹ seeding rates for growing ryegrass in the Southern region of the USA that extends from eastern Texas and Oklahoma to the Atlantic Coast. The southern USA is a humid or high rainfall region, but total rainfall varies substantially in the region. However, these seeding rates are subject to local variation.

MATERIALS AND METHODS

An experiment was started during the monsoon 2003 near the office of Divisional Forest Officer (Rangeland), Muzaffarabad to determine appropriate seeding rate for drill seeding of ryegrass. The experiment was conducted on the eastern aspect of a hill situated in the sub-tropical zone at an elevation of about 670 m with an average rainfall of about one thousand mm per annum. Maximum rainfall is received during July and August in monsoon, whereas winter rainfall mostly occurs in January and February. The soil of the experimental area was homogeneous, clayey and slightly blackish in color indicating adequate concentration of organic matter. Seed of ryegrass was sown in 1.5 x 1.5 m plots. Four seeding rates of 10, 20, 30 and 40 kg ha⁻¹ were replicated three times on a leveled area of a terrace. Seeding was done in manually operated drills drawn at 30 cm spacing from one another at a rate of six drills per plot. Man-operated drills were used, because it was the only convenient soil preparation method for the small terraced area, where tractor or other machinery could not be taken, because of sloppy terrains. Furthermore, drill seeding is

preferred over the broadcast seeding due to more precise depth placement of seed.

After about one and a half year of seeding, plots were harvested flush to the ground level in the mid of February 2005. Soon after the harvest, the plant material was weighed out for determining fresh biomass production. The harvested samples were air-dried and dry matter (DM) production per plot was weighed until the dry weight became constant. Since experiment was conducted over a compact patch of land having homogenized soil, data were analyzed using one-way analysis of variance with the help of software package of MSTAT-C Microcomputer Program, Version 1.3. After harvesting of the grass plots, a soil sample from grass root zone of zero to 15 cm depth was taken from each plot. The collected samples were analyzed to determine the availability of different soil nutrients for plant growth and relate primary productivity with the availability of different soil nutrient factors.

RESULTS AND DISCUSSION

The fresh and dry biomass weights are given below in Table I % water content were calculated by using the following formula:

$$\% \text{ Water} = (W_1 - W_2) 100 / W_1$$

Where, W_1 = Fresh weight of forage; W_2 = Air-dried weight of forage

The relative amount of water may vary, but for green plant material, water is always present in the highest proportion compared to organic matter and mineral contents of the plant material. Mengel and Kirkby (1987) reported that old leaves of plant tissues might contain water from 75 to 85% of the fresh weight. So the results of this study are in harmony with these findings. Although treatment means were not significantly different from one another yet maximum DM was obtained from the minimum seeding rate of 10 kg ha⁻¹. Therefore, minimum seeding rate of 10 kg ha⁻¹ seems better compared to other high seeding rates for achieving maximum forage production from the drill seeding of ryegrass. The high value of approximate significance of 0.346 in Bartlett's test indicates homogeneity of variance across different experimental units/plots that further strengthens the reliability of the findings. The detail of soil test is given in Table IV below: Thirty-five % saturation content depicts that it was a loam soil with high nutrient level and water-holding capacity: therefore, it was suitable for plant growth. The pH was also desirable as plants can avail all the nutrients easily at 7.2 pH level. Organic matter of 2.1% indicates that enough nitrogen was available in the soil. However, the use of phosphorus and potassium fertilizer is recommended, because of slightly low values of available phosphorus and potash to improve DM productivity of the grass.

Table I. Average Fresh Biomass and Dry Matter (DM) Production and Percent Water Content of Perennial Rye under different Seeding Rates

Seeding Rate	Avg Fresh Weight (g plot ⁻¹)	Avg DM Production (g plot ⁻¹)	Percent Water	DM (m. t. ha ⁻¹)
A (10 kg/ha)	1,763	317	82	1.41
B (20 kg/ha)	1,573	266	83	1.18
C (30 kg/ha)	1,033	236	77	1.05
D (40 kg/ha)	1,341	273	80	1.21

Table II. DM Production of Ryegrass obtained from the Plots of different Seeding Rates from a Completely Randomized Design with Four Treatments and Three Replications

Seeding Rate	DM Production (g)			Treatment Total (T)	Treatment Mean
A (10 kg/ha)	243	205	502	950	316.67
B (20 kg/ha)	343	173	282	798	266.00
C (30 kg/ha)	199	267	242	708	236.00
D (40 kg/ha)	137	274	409	820	273.33
				Grand Total:	Grand Mean:
				3,276	273.00

Table III. Analysis of Variance of DM Production in a Completely Randomized Design

Source of Variation	Degrees of freedom	Sum of Squares	Mean Square	F	Prob
Treatment	3	9,974.67	3,324.89	0.25 ^{ns}	
Error	8	106,437.33	13,304.67		
Total	11	116,412.00			

CV = 42.25%; ns = Treatment difference is non-significant because the computed *F* value is smaller than the tabular value. The tabular *F* value at 8 degrees of freedom for the error and 3 degrees of freedom for treatment is 4.07 for the 5 percent level of significance; SE = 66.59; Bartlett's test; Chi-square = 3.311; Number of Degrees of Freedom = 3; Approximate Significance = 0.346

Table IV. Soil Test Report of the Experimental Area

Sr. #	Soil Factor	Desired Range	Reported Value
1	Saturation Content (Percent)	31-44	35
2	Texture	Loam	Loam
3	pH	6.7-7.5	7.2
4	Organic Matter (Percent)	>1.30	2.1
5	Available Phosphorus (ppm)	>15	12.5
6	Available Potash (ppm)	>125	100

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