

10. Grassland and Forage Research

(1) Development of very early maturing Italian ryegrass, the new variety, 'Green farm'

To develop a very early maturing Italian ryegrass for cropping system, research of a new Italian ryegrass variety was carried out between 2009 and 2010 in the experimental fields of National Institute of Animal Science (NIAS). Heading date of Green farm was on 28 of April and the dry matter yield of Green farm was 11,790 kg/ha, and crude protein, in vitro digestibility and total digestible nutrient (TDN) of Green farm were 10.3%, 68.7% and 63.3%, respectively.

Table 10-1. Major characteristics and yield of Green farm ('09~'10)

| Variety | Heading day(M,D) | Plant ht. (cm) | Lodging | Regrowth | Cold tolerance | Dry matter yield (kg/ha) |
|------------|------------------|----------------|---------|----------|----------------|--------------------------|
| Florida 80 | 5.10 | 98 | M* | MS | M | 12,175 |
| Green farm | 4.28 | 93 | M | S | S | 11,790 |

* : M= medium, S= strong, MS = medium and strong

Table 10-2. Feed value of Green farm ('09~'10)

| Variety | Crude protein (%) | in vitro digestibility(%) | NDF (%) | ADF (%) | TDN (%) |
|------------|-------------------|---------------------------|---------|---------|---------|
| Florida 80 | 9.7 | 66.8 | 58.9 | 34.7 | 61.6 |
| Green farm | 10.3 | 68.7 | 54.6 | 32.5 | 63.3 |

* TDN(%) = 88.9 - (ADF x 0.79)

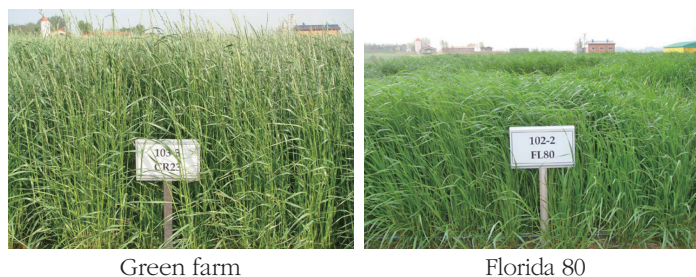


Fig. 10-1. Comparison of heading date (cheonan, 28 April)

(2) Development of 'Purumi' a New Variety of Tall Fescue

Since tall fescue is able to forage crops in such a hot and humid climate as summer in Korea due to its superior environmental adaptability, it is regarded as one of the most appropriate grass that can be perpetually used for a long term.

This study developed a new variety of tall fescue named 'Purumi' with a superior environmental adaptability and high values as a livestock feed so that it might contribute to the activation of the pasture industry in Korea. As a new variety of tall fescue, Purumi is well-resistant to blight and has a favorable quality as a livestock feed, while having superior reproductivity and perpetuality, so that it has turned out to be a new variety with the best cultivation adaptability all over the country in Korea.

Moreover, since Purumi has 2.4% less than the existing varieties in the content of cellulose and 3.4% higher in the digestibility, while its value is being largely improved as a livestock feed.

When this new variety of tall fescue, Purumi, has been developed and distributed with its most remarkable adaptability for Korean climates and superior value as a livestock feed, it is expected to play an important role for a new restoration of the pasture industry in Korea.



Fig. 10-2. Comparison of tall fescue and its growth and development

Table 10-3. Feed value of 'Purumi, Tall Fescue (NIAS, '08~10)

| Variety | Crude Protein(%) | DM Digestibility(%) | NDF (%) | ADF (%) | TDN (%) |
|---------|------------------|---------------------|---------|---------|---------|
| Fawn | 10.7 | 62.8 | 67.0 | 37.0 | 58.8 |
| Purumi | 10.8 | 66.2 | 64.6 | 35.8 | 59.9 |

(3) Feeding effects of Italian ryegrass(Kowinearly) on Hanwoo Steers

Rice straw, IRG silage comparing the nutritive value of protein, respectively, 5.0 and 11.7% higher in Italian ryegrass. In addition, each of TDN content of 43.6 and 61.4%.

The effects of gain and feed efficiency were very distinct during growing stage. Control, 0.67kg and IRG, 0.82kg ridge in compared to the control IRG silage was 22% in salary. Italian ryegrass 10% of grade 1++, 1 + level of 40%, 30% of grade 1 and grade 2 is 20%.

In conclusion, the Italian ryegrass meets a forage crop quality for mulated diets on Hanwoo steers.

Table 10-4. Forage quality of rice straw and Italian ryegrass

| Treatment | CP | C.Fat | IVDMD | TDN |
|------------|------|-------|-------|------|
| Rice straw | 5.0 | 1.9 | 54.0 | 43.6 |
| IRG silage | 11.7 | 3.8 | 67.9 | 61.4 |

Table 10-5. Feeding effects of Italian ryegrass on Hanwoo steers

| Treatment | Control | IRG silage |
|------------------------------|-----------|------------|
| ○ Feed intake(kg/day) | | |
| - Rice straw | 2.3 | - |
| - IRG silage | - | 8.0 |
| - Concentrated | 7.4(100) | 6.2(84) |
| ○ Average daily gain(kg/day) | 0.67(100) | 0.82(122) |
| ○ % of over 1 grade | 50 | 80 |



IRG(Kowinearly)



IRG harvest



Feeding for Hanwoo

Fig. 10-3. Italian ryegrass cultivation and feeding



(4) Apparatus for measuring moisture for silage

Moisture content of the forage crops can greatly influence the fermentation process and storage losses. For the ideal fermentation of silage, moisture content of the forage crops is regarded as primary consideration. Appropriate level of moisture affect to the quality of silage fermentation selectively through controlling the activity and the movement of microorganisms which is involved in silage fermentation. Furthermore, it affects the intake of ruminant livestock. Since moisture content of forage crops is regarded as an important factor for the fermentation and the quality of silage, the production of high quality silage from forage crops can be achieved by harvesting in the proper cutting time. However, some baled silage in the current market frequently contains the excess amount of moisture, because most of the baled silage are not being manufactured in the proper cutting time of forage crops. Practically, production of the baled silage depends on the presence or absence of workers and the weather for manufacturing silage. This irregular environment of baled silage production is one of the major reason for high moisture silage. Especially, baled silage of forage crops, which harvested in inadequate time, caused decreased reliability between livestock farmers and silage producers. This fact induced serious problems and lack of confidence against consumers. From these points of view, development of an instant moisture meter which simply operates and manages what is improve the reliability between livestock farmers and silage producers will be required.

In this study, a scientific moisture meter was designed and developed to measure the moisture content of silage. This device can evaluate the moisture contents through scientific formula of AOAC (The methods of moisture-content measurement indicated by AOAC), indicating that the moisture content of silage can be determined through measurement of weight of silage extracts, which extracted by pressing the raw sample of silage. Since the instant moisture meter can be operated in the absence of electricity but with simple handling by human, it may have great usefulness to measure moisture contents rapidly (4~5 min) and will contribute to the quality improvement of forage crops.

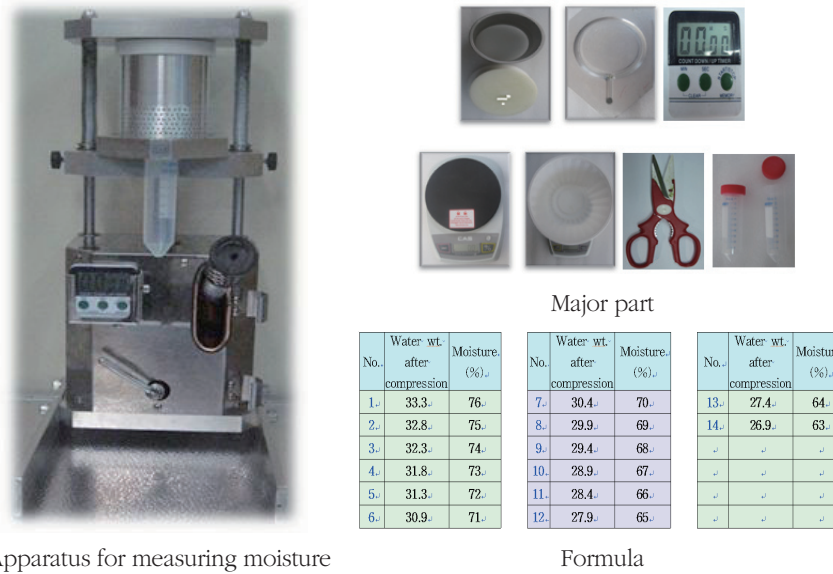


Fig. 10-4. Apparatus for measuring moisture

(5) The investigation of 4 Sorghum x Sudangrass Hybrid Varieties Characteristics for Suitable for Organic Cultivation

This study was carried out to investigate how to use Sorghum x Sudan hybrid cultivars (SSHV) considering the characteristics of SSHV suitable for organic cultivation. SSHV used in this study were SX17, Jumbo, Revolution and G7. SX17 and Jumbo belong to heading and headless types of SSHV, respectively. Revolution have brown midrib trait and G7 is beneficial to manufacture Bail silage because of the thin stems.

To suggest the utilization methods of SSHV, we examined the differences of SSHV through a comparative analysis of the various characteristics related to DM yields, quality of silage, and the amount of silage intake.

DM yield of X17 was higher than that of Jumbo, but a lots of silage can remain because the thick stem diameter of both SX17 and Jumbo cultivars decreased feed intake of cattle. Qualities of silage of SX17 and Revolution were higher than that of th others cultivars, but Jumbo and G7 in feed intake levels of cattle were higher than that of th others cultivars.



Therefore, SX17 and Revolution is good for long term storage and Jumbo and G7 is for short term storage.

Table 10-6. Amount of intaking each sorghum × sudangrass hybrids variety silage (kg)

| Variety | 1st cut(kg) | | | 2nd cut(kg) | | |
|------------|-------------|---------|--------|-------------|---------|--------|
| | Feeding | Refusal | Intake | Feeding | Refusal | Intake |
| SX 17 | 20 | 8,4 | 11,6 | 26,5 | 12,3 | 14,2 |
| Jumbo | 27,5 | 8,7 | 18,8 | 31,5 | 10,5 | 21,0 |
| Revolution | 18,7 | 10,3 | 8,4 | 25,5 | 11,8 | 13,7 |
| G-7 | 27,5 | 9,2 | 18,3 | 31,7 | 7,2 | 24,6 |



Sorghum × sudangrass organic cultivating

Roll bale silage production

Cattle Feeding

Fig. 10-5. Organic Cultivation and feeding of Sorghum × Sudangrass

(6) Yield and quality of *Miscanthus sinensis* as a native grass according to harvest time

This study was carried out in 2010 to investigate yield and nutritive value of *Miscanthus sinensis* as a native grass which might reduce the cost of feeding domestic cattle. As harvesting (31 May, 15 June, 30 June, 15 July, 15 Aug., 30 Sept., and 25 Oct.) was delayed, the dry matter (DM) yield was increased very rapidly, but the forage quality was decreased dramatically.

When harvest were delayed, DM yields were increased ranged from 2,683kg to 10,262kg/ha, and in vitro digestible DM (IVDDM) yields were from 1,784kg to 3,493kg/ha. However, crude protein contents were decreased ranged from 11,7% to 2,5%, relative feed values were from 84,6 to 45,4, and IVDMDs were from 66,5% to 34,0%.

In conclusion, we recommend that *Miscanthus sinensis* should be harvested on June or July to obtain good forage quality richer in forage values than rice straw.

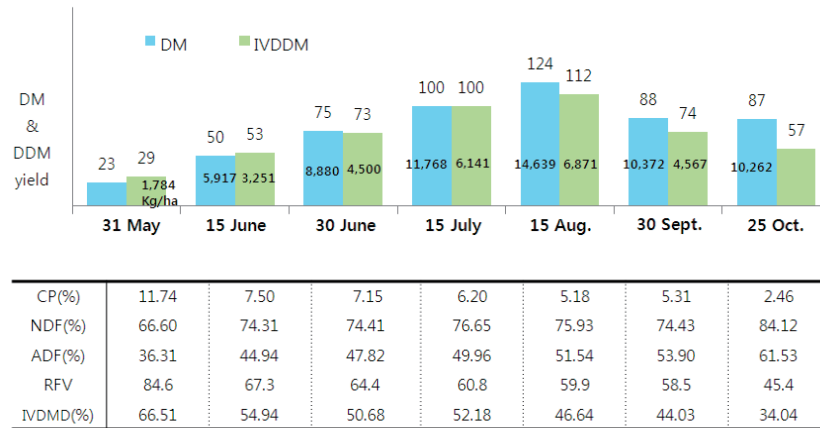


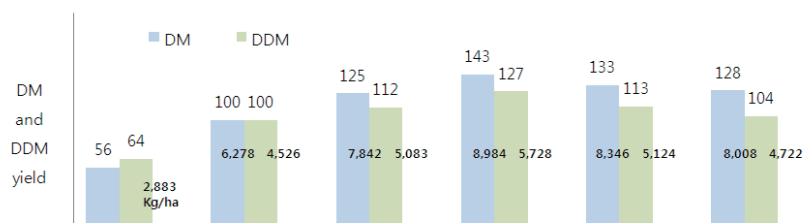
Fig. 10-6. Yield and quality of *Miscanthus sinensis* as a native grass according to harvest time

(7) Optimum Harvest Stage of Italian Ryegrass 'Kowinearly' in Spring season

This study was carried out to determine the forage production and quality of Italian ryegrass (*Lolium multiflorum*, IRG) in spring season. The variety of IRG was Kowinearly of early maturity type, and six harvest stages were first heading(T1), heading(T2), late heading to early bloom(T3), bloom to late bloom(T4), ripeness(T5), and late ripeness stage(T6). The first heading and heading date of Kowinearly were 4 to 5 May, and 14 May, respectively.

Dry matter(DM) percentages at harvest were from 14.79% at T1 to 35.02% at T6. The content of crude protein(CP) and in vitro DM digestibility (IVDMD) were decreased continuously with delayed harvest. A significant higher DM yield, CP yield and in vitro DDM (IVDDM) yield were observed at T4 and T3 ($p < 0.05$).

In conclusion, at late heading to bloom stage was recommended as a optimum harvest stage when one time harvest of Kowinearly during spring season.



| Harvest time | First heading | Heading | Late heading ~early bloom | Bloom~ late bloom | Ripeness | Late ripeness |
|------------------|---------------|---------------|------------------------------|----------------------|---------------|---------------|
| Daily DM (kg/ha) | 55.1 (62) | 88.4 (100) | 100.5 (114) | 105.7 (120) | 90.7 (103) | 81.7 (92) |
| CP(%) | 15.6 | 10.6 | 10.1 | 8.1 | 7.3 | 5.4 |
| RFV | 127.7 | 103.7 | 91.9 | 93.0 | 100.6 | 102.4 |
| IVDMD(%) | 81.8 | 72.1 | 64.8 | 63.8 | 61.4 | 59.0 |

Fig. 10-7. Optimum harvest stage of Italian ryegrass 'Kowinearly'