**ICAR-National Institute of Animal Nutrition and Physiology (NIANP), Bengaluru**

**Objectives**

1. To evaluate nutrient composition of value added cereals (VAC) crop residues
2. To compare nutrient bioavailability of VAC crop residues using *in vitro*/*in sacco* study

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**Wheat:** Grain, straw and bran of six promising wheat varieties viz., WB-2, DBW-39, DBW-88, WH-1105, HD-3059 and HD-3086 received from IIWBR, Karnal were analyzed for nutrient composition. The nutrient composition of straw has shown the lowest crude fibre (40.4%) and the highest NFE (Nitrogen Free Extract) was (46.6%) in WH-1105. Bran of HD 3059 has higher CP (16.4%) than other varieties. Analyses of micro minerals like Zn, Fe, Mn and Cu in straw samples of six varieties have shown slightly higher zinc in HD 3086 and Fe in WB2. Bran of DBW 39 showed higher zinc and grain Zn was higher in HD 3059. Other micro minerals are almost similar in wheat grain and their byproducts.

**Sorghum**: Ten samples of Sorghum stover varieties (AKSV 388, AKSV 278, AKSV 346, AKSV 395, AKSV 314, AKSV 387, AKSV 318, AKSV 382, AKSV 161, PVK 801) were received from PDKV, Akola and analysed for nutrient composition. The crude fibre was higher in AKSV 314 and AKSV 382, whereas NFE was higher in AKSV 395 and lowest was found in AKSV 314 stover. Macro minerals like calcium, phosphorus and Mg (%) were found to be similar in different varieties of sorghum straw. However, Zn (ppm) was found to be more in ASKV 161 (34.90) followed by ASKV 395 (32.74). Similarly Fe (ppm) was more in ASKV 314 (93.04) followed by ASKV 318 (92.69). Highest Cu (ppm) was found in ASKV 314 (9.04).

**Pearl Millet:** Stover samples of six varieties of pearl millet (PPMI903 (b), PPMI904 (b), 15458, PC383, PC443 and PC 701) were received from IARI, New Delhi. PPMI 904(b) has shown higher CP (10.65%), Ca, P, Zn and Fe and lower fibre (28.32%). Out of 16 stover samples received from AICRP Mandur, M2 variety has slightly higher CP (7.90) than other varieties along with higher ash content (14.12%).

**Rice:** Seven rice varities (Kondai, IG39, Co51, Chittimuthyalu, Dhan45, Kalanamak and MTU-1010) straw samples received from IIRR, Hyderabad. The variety Chittimuthyalu was having higher CP, IVDMD, IVOMD, NH3-N, TVFA and TDN (Crude Protein, In vitro dry matter digestibility, In vitro organic matter digestibility, Ammonical nitrogen, Total volatile fatty acids, Total digestible nutrients) than other varieties, followed by Kalanamak. The variety Chittimuthyalu also was having higher P, Mg and Zn. Dhan 45 also having higher Zn and Cu. Two paddy varieties (Kalanamak (K), Improved Kalanamak (IK) straw samples received from IARI Delhi, CP (4.39%) content was higher in improved Kalanamak than other variety. Iron and Ca is high in IK and P & Zn is high in K.

Table 1: Nutrient composition (%) of different varieties of wheat straw, grain and bran.

| Variety | Crude Protein | Total Ash | AIA | Crude Fat | Crude Fiber | NFE |
|---|---|---|---|---|---|---|
| ***Wheat Straw*** | | | | | | |
| WB-2 | 2.99 | 8.19 | 5.18 | 1.09 | 44.17 | 43.55 |

| | | | | | | |
|---|---|---|---|---|---|---|
| DBW-39 | 3.21 | 6.20 | 4.27 | 1.11 | 43.99 | 45.48 |
| DBW-88 | 2.68 | 6.95 | 5.35 | 1.03 | **46.16** | 43.18 |
| WH-1105 | 2.79 | **8.96** | 6.17 | **1.24** | 40.40 | 46.60 |
| HD-3059 | 3.47 | 8.64 | **6.57** | 1.20 | 44.00 | 42.68 |
| HD-3086 | **3.97** | 7.59 | 5.73 | 1.00 | 42.87 | 44.68 |
| ***Wheat Grain*** | | | | | | |
| WB-2 | **11.90** | **1.65** | Nil | 1.42 | 2.12 | 82.91 |
| DBW-39 | 11.60 | 1.55 | Nil | 1.51 | 1.58 | 83.76 |
| DBW-88 | 10.83 | 1.60 | Nil | **1.94** | 2.19 | 83.44 |
| WH-1105 | 10.99 | 1.45 | Nil | 1.51 | 2.26 | 83.79 |
| HD-3059 | 11.03 | 1.54 | Nil | 1.53 | **2.48** | 83.42 |
| HD-3086 | 11.14 | 1.48 | Nil | 1.21 | 2.16 | 84.01 |
| ***Wheat Bran*** | | | | | | |
| WB-2 | 14.25 | 2.09 | Nil | 2.63 | 2.95 | 78.08 |
| DBW-39 | 13.90 | **3.09** | Nil | 3.45 | 4.19 | 75.37 |
| DBW-88 | 13.20 | 2.10 | Nil | 3.22 | 3.18 | 78.30 |
| WH-1105 | 14.35 | 2.45 | Nil | 3.17 | 3.87 | 76.16 |
| HD-3059 | **16.40** | 2.65 | Nil | **3.55** | **4.49** | 72.91 |
| HD-3086 | 13.75 | 2.50 | Nil | 2.66 | 4.00 | 77.09 |

**Table 2: Mineral composition (ppm) of different varieties of wheat straw, grain and bran**

| Variety | Zn | Fe | Mn | Cu |
|---|---|---|---|---|
| *Wheat* straw | | | | |
| WB 2 | 0.49 | **337.0** | 13.0 | 0.40 |
| DBW 39 | 1.27 | 274.0 | 10.6 | 0.83 |
| DBW 88 | 2.19 | 191.5 | 12.2 | 0.18 |
| WH 1105 | 1.50 | 241.4 | **15.3** | **1.85** |
| HD 3059 | 0.37 | 233.1 | 12.1 | 0.12 |
| HD 3086 | **2.56** | 166.5 | 11.6 | 0.38 |
| *Wheat grain* | | | | |
| WB 2 | 33.3 | 91.8 | 37.6 | 5.97 |
| DBW 39 | 30.5 | **108.9** | 38.3 | 6.58 |
| DBW 88 | 26.2 | 94.4 | 38.3 | **8.47** |
| WH 1105 | 29.5 | 85.5 | 37.8 | 6.67 |
| HD 3059 | **42.5** | 84.6 | 42.9 | 4.93 |
| HD 3086 | 27.8 | 87.1 | **44.1** | 5.68 |
| *Wheat Bran* | | | | |
| WB 2 | 45.8 | **187.4** | 48.2 | 7.52 |
| DBW 39 | **66.8** | 128.4 | 59.6 | 6.26 |
| DBW 88 | 53.7 | 107.3 | 52.3 | 6.86 |
| WH 1105 | 60.9 | 148.1 | 56.9 | **9.32** |
| HD 3059 | 46.0 | 133.0 | **60.4** | 7.44 |
| HD 3086 | 38.5 | 140.3 | 54.3 | 7.70 |

Table 3: Nutrient composition (%) of different varieties of sorghum straw

| Variety | Crude Protein | Total Ash | AIA | Crude Fiber | Crude Fat | NFE |
|---|---|---|---|---|---|---|
| AKSV 388 | 3.53 | 6.34 | 3.14 | 30.06 | 1.24 | 58.83 |
| AKSV 278 | 3.07 | 6.54 | 4.43 | 32.23 | 1.46 | 56.70 |
| AKSV 346 | 4.27 | 6.53 | 3.94 | 29.80 | 1.18 | 58.22 |
| AKSV 395 | 3.64 | 6.68 | 3.99 | 27.91 | 1.32 | **60.45** |
| AKSV 314 | 3.23 | 7.63 | 5.18 | **35.35** | 0.98 | **52.81** |
| AKSV 387 | 2.96 | 6.37 | 3.80 | 31.54 | 1.37 | 57.76 |
| AKSV 318 | 3.79 | 8.43 | 5.75 | 29.51 | 1.04 | 57.23 |
| AKSV 382 | 2.73 | 6.48 | 4.13 | **34.85** | 1.02 | 54.92 |
| AKSV 161 | 3.47 | 8.26 | 5.32 | 30.64 | 1.36 | 56.27 |
| PVK 801 | **6.35** | **9.22** | **6.00** | 26.84 | 0.66 | 56.93 |

Table 4: Mineral concentration in different varieties of sorghum straw

| Variety | Macro Minerals (%) | | | Micro minerals (ppm) | | |
|---|---|---|---|---|---|---|
| | Ca | P | Mg | Zn | Fe | Cu |
| AKSV 388 | 0.03 | 0.80 | 0.15 | 28.83 | 41.55 | 2.74 |
| AKSV 278 | 0.03 | 0.69 | 0.13 | 26.44 | 30.92 | 1.85 |
| AKSV 346 | 0.03 | 0.72 | 0.13 | 28.00 | 37.16 | 3.34 |
| AKSV 395 | 0.03 | 0.81 | 0.14 | 32.74 | 49.86 | 4.83 |
| AKSV 314 | 0.03 | 0.70 | 0.13 | 24.81 | 93.04 | 9.04 |
| AKSV 387 | 0.03 | 0.77 | 0.16 | 22.75 | 34.26 | 2.39 |
| AKSV 318 | 0.03 | 0.81 | 0.16 | 27.63 | 92.69 | 3.88 |
| AKSV 382 | 0.03 | 0.77 | 0.14 | 23.91 | 80.11 | 2.23 |
| AKSV 161 | 0.03 | 0.96 | 0.17 | **34.90** | 80.41 | 5.39 |
| PVK 801 | 0.03 | 0.87 | 0.16 | 29.52 | 51.26 | 4.57 |

***Table 5: In vitro* gas production and digestibility of different varieties of paddy straw samples (IIRR, Hyderabad)**

| Component | Kondai | IG39 | Co51 | Chittimuthyalu | Dhan 45 | Kalanamak | MTU-1010 | SEM | P-Value |
|---|---|---|---|---|---|---|---|---|---|
| Gas (ml/200mg) | 24.2c | 26.8b | 22.8d | 30.2a | 20.9e | 22.4d | 19.0f | 0.47 | <0.001 |
| TDMD% | 56.5bc | 59.6ab | 59.1ab | 61.4a | 52.2d | 54.6cd | 51.9d | 0.59 | <0.001 |
| DOM% | 57.8bc | 60.6ab | 59.7ab | 62.3a | 53.2d | 55.5cd | 53.0d | 0.59 | <0.001 |

Publications: N.M. Soren , K.S. Prasad, S.B.N Rao, Y.A.N Reddy, M. Terhuja and G. Dominic (2016) In vitro Evaluation of Biofortified Small Millets Straw Varieties as

Livestock Feed In: Abstract Paper: Proceedings of X Biennial Animal Nutrition Association Conference Tirupati, India. p. 66.