

Technological evaluation of the sliced-dedusted straw as an alternative type of bedding material in broiler chicken farming

Maksimiljan Brus¹, Jernej Prišenk^{1*}

Abstract

The aim of this study is to present the technological viability of sliced-dedusted straw as one of the alternative types of bedding material in broiler chicken production process. Results are based on the results from national research project supported and financed by Slovenian Agency for Agricultural Markets. The input data and results are based on the real case studies (two farms) from Slovenia. One of the farms represents the extensive and second one represents the intensive production type. In the course of this paper authors explain technological benefits from using sliced-dedusted straw as the alternative bedding material compared to wood shavings. The novelty of the research is in creating the assessment protocol which includes the ethological animal standards. Results show significant priorities which are shown through the injury reduction on animals at the end of the feeding period.

Keywords: Sliced-dedusted straw, bedding material, broiler chicken, technology assessment

Introduction

Bedding material acquisition and litter management are important issues for broiler producers. The sustainability of broiler production requires bedding material to be environmentally friendly, and the replacement of litter needs to be efficient and cost-effective in order to be implemented by growers in a profitable way (Bilgili et al., 2009). A good litter material should be able to absorb and release moisture to the environment as quickly as possible (Garcês et al., 2013). Several factors including unavailability, increasing cost, and possible health and safety risks of conven-

tional materials have been the major forces driving research to new bedding materials for commercial poultry (Diarra et al., 2021). In view of differences in the availability of substrates used for bedding materials among regions, reviews summarizing the characteristics of alternative materials, their effectiveness, and major issues would benefit the poultry industry (Almeida et al., 2010). These attributes should be taken into account when decision processes are the question. The results of this paper can bring a good contribution as a way to improve or develop some new criteria (from the

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ethological aspect) which can be taken into account during the quality assessment of bedding materials. During the literature review, we identified a lot of studies which assessed the quality of bedding material through its technological assessment, but research forgot to assess the bedding material through its well-being criteria for animals. Authors recognized the good contribution of this paper from two different aspects; i) sliced-dedusted straw is one of the alternative types of bedding materials and ii) its quality value has been defined according to ethological standards, not only economic values.

Sliced-dedusted straw is produced by one of Slovenian companies, and it has already been used as a bedding material in horse breeding (Prišenk et al., 2017). The results in this study recognize the technological and economic benefits

in horse breeding technology. From this aspect it is necessary to assess this alternative type of bedding material as one of the options for broiler chickens. The results were based on the field research studies on two different farms from Slovenia.

The novelty of this research is in creating the assessment protocol which was specified by authors and based on the preliminary literature reviews. This contribution can lead to new and easy assessment procedure which can be easily handled by farmers or producers.

More deeply, the explanation can be found under methodology Insert (Table 1). The paper follows the academic standard writing while presenting the scientific results including discussion section and explaining the future scientific challenges in the conclusion section.

Table 1 Setup of observed data for further implementation

No. of observation	Type of observation	Explanation of observation	Number of classes	Abbreviation of classes and description	Measurement unit
I	Daily assessment of bedding material quality	Assessment of bedding materials	5 (0, 1, 2, 3, 4)	0 – Dry and flaky, moves easily with the foot 1 – Dry but not easy to move with foot 2 – Leaves imprint of foot 3 – Sticks to boots and sticks readily in a ball if compacted 4 – Sticks to boots once the cap or compacted crust is broken	Quantitative assessment
II	Daily assessment of animal activities	Observation of different animal activities	5 (values from 0 % to 100 %. Total amount is 100 %)	1 - Research activity 2- Feed searching 3- Browsing 4 - Dust bath 5 - Resting	Percentage (%)
III	Achieved body weight of live animals and weight of slaughtered animal	The weight of body weight at the end of fattening period and the weight of carcasses	2	1 – Live body weight 2- Carcass weight	Grams (g)
IV	Incidence of footpad dermatitis estimates on animals	Assessment of incidence of footpad dermatitis	5 (0, 1, 2, 3, 4)	0 – FPD 0 1 – FPD 1 2 – FPD 2 3 – FPD 3	Quantitative assessment of breeders from 0 to 4. (e.i. 0 – no footpad dermatitis)
V	Incidence of hock burns on animals	Assessment of incidence of hock burns	5 (0, 1, 2, 3, 4)	0 – HB 0 1 – HB 1 2 – HB 2	Quantitative assessment of breeders from 0 to 2. (e.i. 0 – no hock burns 4 – huge hock burns)
VI	Incidence of chest blisters on animals	Assessment of incidence of chest blister	5 (0, 1, 2, 3, 4)	0 – CB 0 1 – CB 1 2 – CB 2 3 – CB 3 4 – CB 4	Quantitative assessment of breeders from 0 to 4. (e.i. 0 – no chest blisters 4 – huge chest blisters)

Material and methods

Two farms were taken into consideration. For clearer interpretation and to avoid any ambiguity we named it as Farm No. 1 and Farm No. 2. The GPS coordinates of the farm 1 are 46°37'57.3"N 15°27'04.2"E and for farm 2 are 46°17'20.5"N 15°25'26.0"E. The production capacity of farm 1 is approx. 130 broiler chickens and on the farm 2 the total capacity is approx. 11000 broiler chickens in one feeding period.

Assessment protocol was based on the criteria which were taken from specific veterinary science, ethology standards and behavioural elements. The protocol was prepared according to various existing protocols for the assessment of animal welfare, but which are not entirely suitable for the daily assessment of animal welfare by farmers (Welfare Quality, 2009; AssureWel, 2020; Ebene, 2020). Broilers were reared in accordance to Slovenian legislation (Directive/43/ES, UL RS no. 51/2010, UL RS, no. 38/2013) and recommendations for broilers ROSS 308 (Aviagen, 2018). Breeders took the assessment protocol list at the start of every repetition of the survey. For calculation of the statistical significance values it was necessary to collect a representative number of observations. According to that, 764 observations or assessment/

input data were collected. Data were collected on observations of different criteria, such as *i) daily assessment of bedding material quality, ii) daily assessment of animal activities, at slaughter was determined iii) achieved live weight and carcass weight, iv) incidence of foot pad dermatitis, v) Incidence of hock burns and vi) incidence of breast blisters.*

Input data have different measurement units and other characteristics which are presented in table 1.

Assessment protocol was carried out by farm breeders during all repetitions. Observations I and II have been collected daily, while the others were collected at the end of the fattening period. During the research 6 repetitions were carried out on the farms. After getting the input data from all repetitions from both farms, researchers were focused on data conversion. This step was done by Excel MS Office program and data were further classified and available for further statistical analysis in SPSS IBM ver. 25.1 program. Because the performance of the research project is in the second year (the duration of the project is stated as 3 years), here we present only preliminary results in the way of statistical significations for every type of observations. For further data, processing authors plan to identify any statistical correlations.

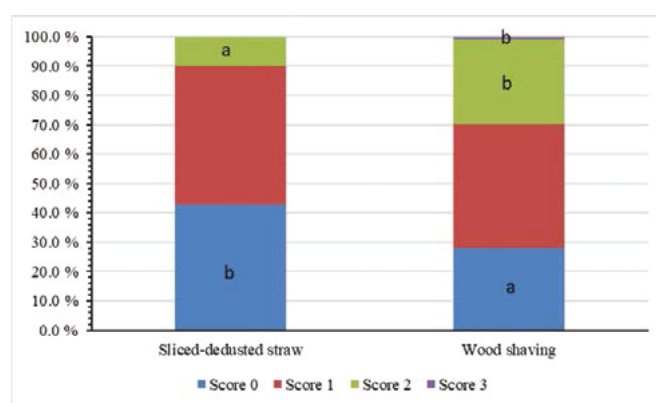


Figure 1: Litter quality assessment

Results and discussion

The results are presented separately for different assessments according to bedding materials, animal activities and technological characteristics.

During the analysis based on the incidence of litter quality assessments (Figure 1), we found a significant ($p \leq 0.05$) difference between sliced-dedusted straw and wood-shaving in the incidence of

scores 0 and 2. The incidence of score 3 we found only at wood-shaving, but none in the sliced-dedusted straw. In the case of sliced-dedusted straw, we find a significantly ($p \leq 0.05$) higher incidence of the score 0 compared to wood shaving. Thus, the animals spent more time on dry and loose bedding. There was no significant difference in the incidence

of score 1 for litter between sliced-dedusted straw and wood shaving. The incidence rate of score 2 differs significantly ($p \leq 0.05$) between both litter materials. Significantly ($p \leq 0.05$) lower incidence of score 2 was found at the sliced-dedusted straw in comparison to the wood-shaving. In the case of wood-shaving, a score 3 also appears, which was not observed at sliced-dedusted straw and this lead

to significant difference ($p \leq 0.05$) in comparison to sliced-dedusted straw. Based on the assessment of bedding quality in accordance with the protocol (Welfare Quality. 2009), sliced-dedusted straw was able to absorb moisture from the environment faster and retain it longer, based on changed physical properties, which was reflected in a significantly higher share of 0.

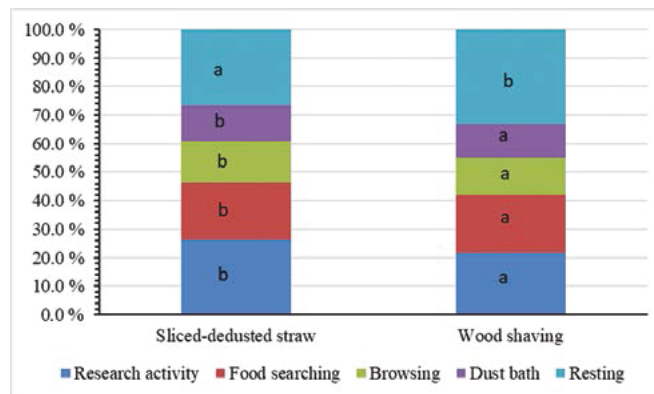


Figure 2: Behaviour activity assessment

Figure 2 shows the significant differences ($p \leq 0.05$) in the identified individual activities of chickens on different litters (sliced-dedusted straw or wood shaving) used in the observation. Chickens housed on the sliced-dedusted straw showed

significantly ($p \leq 0.05$) more activity as a research activity, feed search, browsing, and dust baths. Significantly ($p \leq 0.05$) highest incidence of resting was found on wood shaving.

In the analysis of slaughter data, 249 animals

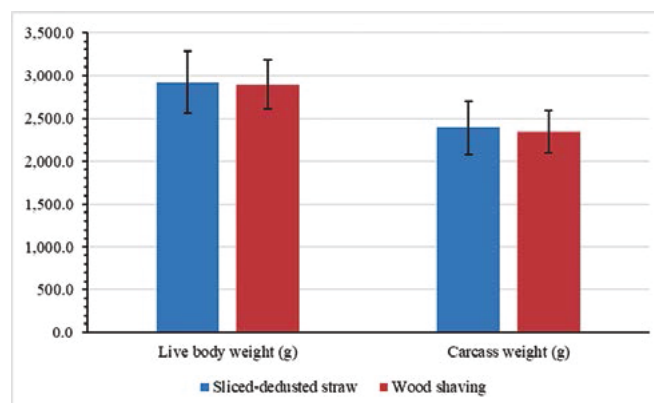


Figure 3: Live body weight and carcass weight of chickens

from three farms were included. Three tests with sliced-dedusted straw and three tests with wood shaving were performed on each farm. Statistical comparison of live weight and weight of cleaned carcasses between groups of animals fed on straw or sawdust did not show significant differences.

Analysis of the incidence of footpad dermatitis (FPD) in chickens (Figure 4) housed on sliced-dedusted straw or wood shaving showed significant ($p \leq 0.05$) difference. Higher number of animals without FPD was found on sliced-dedusted straw compared

to wood shaving. The other two classes 1 and 2 on sliced-dedusted straw were significantly ($p \leq 0.05$) lower compared to wood shaving.

Statistical analysis of the incidence of hock burns (HB) in chickens (Figure 5) reared on sliced-dedusted straw or wood shaving showed significantly ($p \leq 0.05$), respectively. Significantly more chickens without injuries were reared on sliced-dedusted straw compared to wood shaving. The incidence of HB 1 and HB 2 damage on sliced-dedusted straw was significantly ($p \leq 0.05$) lower compared to wood shaving.

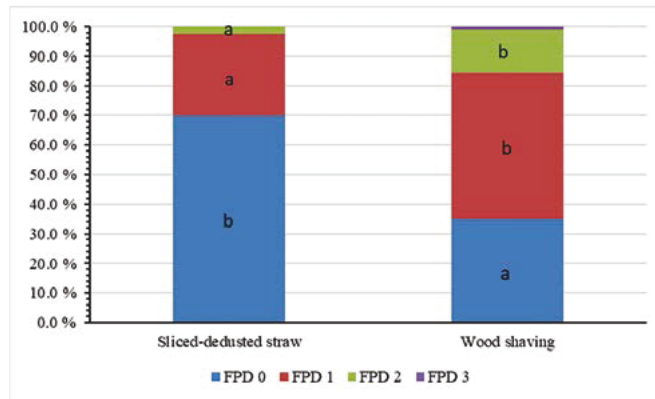


Figure 4: Incidence of footpad dermatitis (FPD)

Analysis of the incidence of chest blisters (CB) in chickens (Figure 6) showed an insignificant difference in the proportion of CB 0 lesions in both groups. A significantly ($p \leq 0.05$) higher proportion of CB 1 lesions was found on sliced-dedusted straw than on wood shaving. Incidence of CB 2 was significantly less on sliced-dedusted straw than

on wood shaving. The incidence of CB 3 damage was only on wood shaving. Thus, the occurrence of a higher proportion of FPD, HB and CB damage can be associated with prolonged wet litter in the rearing period of broilers and is in accordance with literature findings (de Jong et al., 2014).

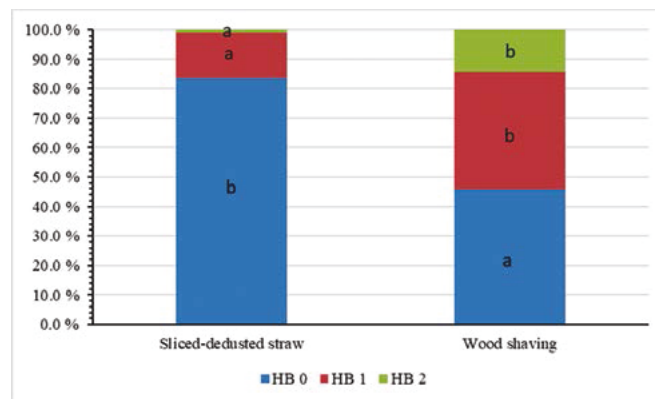


Figure 5: Incidence of hock burns

Conclusion

A new technological approach to straw processing has contributed to a significant improvement in the physical properties of straw as expected for excellent bedding (Dunlop et al., 2016a, Dunlop et

al., 2016b). Based on the findings and statistical analyses of the experimental data, we can conclude that the use of sliced-dedusted straw resulted in achieved better living conditions for chickens, as they were

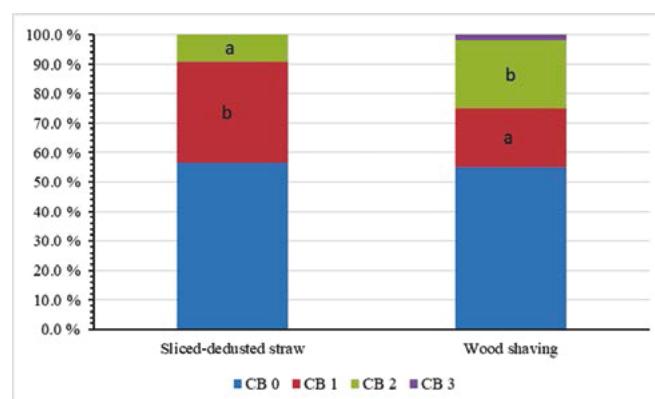


Figure 6: Incidence of chest blisters (CB)

raised on dry litter for a longer time period (Figure 1). Such good conditions provided the chickens on the sliced-dedusted straw with more movement activity and development of positive interactions compared to wood shaving (Figure 2). However, a greater proportion of movement did not result in achieved lower body weight or lower carcass weight

(Figure 3). Despite the higher activity, the animals on sliced-dedusted straw suffered significantly less damage to the foot pad dermatitis (FPD) (Figure 4), as well as significantly less hock burns HB (Figure 5) and significantly fewer higher-grade chest blisters (CB) (Figure 6).

References

- [1] Almeida, Paz ICL., RG. Garcia, R. Bernardi, IA Nääs, FR Caldara, LW Freitas LW. (2010): Selecting appropriate bedding to reduce locomotion problems in broilers. *Brazil J Poultry Sci.* 12, 189–95. <https://doi.org/10.1590/S1516-635X2010000300008>
- [2] AssureWel (2020): [http://www.assurewel.org/Portals/2/Documents/Assure Wel%20brochure.pdf](http://www.assurewel.org/Portals/2/Documents/AssureWel%20brochure.pdf)
- [3] Aviagen (2018): Ross broiler management handbook. http://en.aviagen.com/assets/Tech_Center/Ross_Broiler/Ross-BroilerHandbook2018-EN.pdf
- [4] Diarra, S., S. Lameta, F. Amosa, S. Anand (2021): Alternative Bedding materials for poultry: availability, efficacy and major constraints. *Front. Vet. Sci.*, 8, 1-8. doi: 10.3389/fvets.2021.669504
- [5] Garcês, A, SMS. Afonso, A. Chilundo, CTS Jairoce. (2013): Evaluation of different litter materials for broiler production in a hot and humid environment: 1. litter characteristics and quality. *J Appl Poultry Res.* 22,168–76. <https://doi.org/10.3382/japr.2012-00547>
- [6] Prišenk, J., J. Turk, Č. Rozman, K Pažek, M Janžekovič (2017): Feasibility analysis of different bedding materials for horses. *J Appl. Anim. Res.*, 46 (1), 798-803. <https://doi.org/10.1080/09712119.2017.1403919>
- [7] de Jong, I. C., H. Gunnink, J. van Harn (2014): Wet litter not only induces footpad dermatitis but also reduces overall welfare, technical performance, and carcass yield in broiler chickens. *The Journal of Applied Poultry Research*, 23, 51–58
- [8] Ebene (2020): [https://www.itavi.asso.fr/sites/default/files/files/EBENE_fiche_commune\(1\).pdf](https://www.itavi.asso.fr/sites/default/files/files/EBENE_fiche_commune(1).pdf)
- [9] Welfare Quality (2009): The Welfare Quality® assessment protocol for poultry (broilers, laying hens). The Welfare Quality® Consortium, Lelystad, The Netherlands. <http://edepot.wur.nl/233471>
- [10] Dunlop, MW, J. McAuley, PJ. Blackall, RM Stuetz (2016a): Water activity of poultry litter: Relationship to moisture content during a grow-out. *J. Environ. Manage.*, 172:201-206. DOI:10.1016/j.jenvman.2016.02.036
- [11] Dunlop, MW, AF. Moss, P.J. Groves, S.J. Wilkinson, R.M. Stuetz, P.H. Selle (2016b): The multidimensional causal factors of 'wet litter' in chicken-meat production. *Sci. Total Environ.*, 562,766-776. DOI:10.1016/j.scitotenv.2016.03.147
- [12] Directive/43/ES; Directive Laying Down Minimum Rules for the Protection of Chickens Kept for Meat Production. Council directive 2007/43/ES. EU: Brussels, Belgium, 2007; pp. 19–28.
- [13] UL RS no. 51/2010; Rules on the Protection of Livestock. Regulation. Ministry of Agriculture, Forestry and Food: Ljubljana, Slovenia, 2010; pp. 1–18.
- [14] UL RS, no. 38/2013; Animal Protection Act (Official Consolidated Text) (ZZZiv-UPB3). Ministry of Agriculture, Forestry and Food: Ljubljana, Slovenia, 2013; pp. 1–12.

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Tehnološka evaluacija rezane otprašene slame kao alternativnog materijala za stelju u uzgoju brojlera

Sažetak

Cilj ovog istraživanja je prezentirati tehnološku održivost rezane otprašene slame kao jednog od alternativnih tipova stelje u proizvodnom procesu brojlera. Rezultati su temeljeni na rezultatima nacionalnog istraživačkog projekta podržanog i financiranog od strane Slovenske agencije za poljoprivredna tržišta. Ulazni podaci i rezultati temeljeni su na dvije stvarne analize slučaja (dvije farme) iz Slovenije. Jedna od farmi predstavlja ekstenzivan, a druga predstavlja intenzivan tip proizvodnje. Kroz rad autori objašnjavaju tehnološke prednosti korištenja rezane otprašene slame kao alternativnog materijala za stelje u usporedbi s drvnom piljevinom. Novost ovog istraživanja je stvaranje protokola procjene koji uključuje etološke životinjske standarde. Rezultati pokazuju značajne prednosti koje su prikazane kroz smanjenje ozljeda na životinjama na kraju perioda hranidbe.

Key words: Rezana otprašena slama, materijal za stelju, brojler, tehnološka procjena

Technologische bewertung des geschnittenen und entstaubten strohs als alternative einstreu für die hähnchenmast

Zusammenfassung

Ziel dieser Untersuchung ist es, die technologische Einsetzbarkeit von geschnittenem, entstaubtem Stroh als eine der alternativen Arten von Einstreumaterial in der Masthähnchenproduktion darzustellen. Die Ergebnisse basieren auf den Ergebnissen eines nationalen Forschungsprojekts, das von der slowenischen Agentur für Agrarmärkte unterstützt und finanziert wurde. Die Eingangsdaten und Ergebnisse basieren auf realen Fallstudien (zwei Betriebe) aus Slowenien. Einer der Betriebe repräsentiert den extensiven und der zweite den intensiven Produktionstyp. Im Beitrag erläutern die Autoren die technischen Vorteile der Verwendung von geschnittenem, entstaubtem Stroh als alternatives Einstreumaterial im Vergleich zu Holzspänen. Die Neuheit dieser Untersuchung besteht in der Erstellung eines Bewertungsprotokolls, das die ethologischen Tierstandards einschließt. Die Ergebnisse zeigen signifikante Vorteile, die sich in der Verringerung von Verletzungen bei den Tieren am Ende des Mastzeitraums zeigen.

Schlüsselwörter: Geschnittenes und entstaubtes Stroh, Einstreumaterial, Masthähnchen, Technologiebewertung

Evaluación tecnológica de la paja desempolvada cortada como el material alternativo de tipo de cama en la crianza de pollos broiler

Resumen

El objetivo de esta investigación fue presentar la sustentabilidad tecnológica de la paja desempolvada cortada como una de las alternativas de tipo de cama en el proceso de producción de pollos broiler. Los resultados están basados en los resultados de un proyecto de investigación nacional apoyado y financiado por la Agencia de Mercados Agrícolas de Eslovenia. Los datos de entrada y los resultados están basados en dos estudios de casos reales (dos granjas) de Eslovenia. Una de las granjas representa un tipo de crianza extensiva y la otra un tipo intensivo. A través del artículo, los autores explican las ventajas tecnológicas del uso de la paja desempolvada como un material alternativo para la cama en comparación con el aserrín de madera. La novedad de esta investigación es la creación de un protocolo de evaluación que incluye estándares etológicos de los animales. Los resultados muestran beneficios significativos a través de la reducción de lesiones en los animales al final del período de alimentación.

Palabras claves: paja desempolvada cortada, material de cama de animales, pollo broiler, evaluación tecnológica

Valutazione tecnologica della paglia tagliata e depolverizzata come materiale da lettiera alternativo nell'allevamento dei polli da carne

Riassunto

Lo scopo di questa ricerca è presentare la sostenibilità tecnologica della paglia tagliata e depolverizzata come uno dei materiali da lettiera alternativi nel processo di produzione e allevamento dei polli da carne. I risultati si basano sull'esito del progetto di ricerca nazionale sostenuto e finanziato dall'Agenzia slovena per i mercati agricoli. I dati di input e i risultati si basano su due casi di studio reali (due aziende agricole) della Slovenia, una rappresentativa del tipo di produzione agricola estensiva, l'altra del tipo di produzione agricola intensiva. In questo articolo gli autori spiegano i vantaggi tecnologici derivanti dall'utilizzo della paglia tagliata e depolverizzata come materiale da lettiera alternativo rispetto ai trucioli del legno. La novità della ricerca sta nella creazione d'un protocollo di valutazione che includa gli standard etologici animali. I risultati mostrano vantaggi significativi che si manifestano attraverso la riduzione delle lesioni sugli animali al termine del periodo di alimentazione.

Parole chiave: paglia tagliata e depolverizzata, materiale da lettiera, polli da carne, valutazione tecnologica