

DAFTAR PUSTAKA

- Agegnehu, G., Ghizaw, A., & Sinebo, W. (2006). Yield performance and land-use efficiency of barley and faba bean mixed cropping in Ethiopian highlands. *European Journal of Agronomy*, 25(3), 202–207. <https://doi.org/10.1016/j.eja.2006.05.002>
- Ahmad, A., Wahid, M.A., Fazal, M.W., Anees, M.U., Arshad, M.A., & Saeed, M.T. (2016). Agro-Economic Assessment of Maize-Soybean Intercropping System. *American-Eurasian J. Agric. & Environ. Sci.*, 16(11): 1719-1725. <https://doi.org/10.5829/idosi.aejaes.2016.1719.1725>
- Akunda, E.M. (2001). Inter cropping and population density effects on yield component, seed quality and photosynthesis of sorghum and soybean. *The Journal of Food Technology in Africa*, 6(3), 96–100. <https://doi.org/10.4314/jfta.v6i3.19298>
- Alfi, I., Elisabeth, D.A.A., Muzaiyanah, S., & Putri, P.H. (2020). *Hasil Utama Penelitian Tanaman Aneka Kacang dan Umbi* (Issue Mi). Balai Penelitian Tanaman Aneka Kacang dan Umbi.
- Allen, L.H., Zhang, L., Boote, K.J., & Hauser, B.A. (2018). Elevated temperature intensity, timing, and duration of exposure affect soybean internode elongation, mainstem node number, and pod number per plant. *Crop Journal*, 6(2), 148–161. <https://doi.org/10.1016/j.cj.2017.10.005>
- Al-Tawaha, A.R.M. (2010). Effect of growth stage and pod position on soybean seed isoflavone concentration. *Notulae Botanicae Horti Agrobotanici Cluj-Napoca*, 38(1), 92–99.
- Aminah, I.S., Budianta, D., Perto, Y., & Sodikin, E. (2014). Tumpangsari jagung (*Zea mays* L.) dan kedelai (*Glycine max* L. Merrill) untuk efisiensi penggunaan dan peningkatan produksi lahan pasang surut. *Jurnal Tanah dan Iklim*, 38(2), 119–128.
- Amir, B., Indradewa, D. & Putra, E.T.S. (2015). *Hubungan bintil akar dan aktivitas nitrat reduktase dengan serapan N pada beberapa kultivar kedelai (Glycine max) 1*, 1132–1135. <https://doi.org/10.13057/psnmbi/m010528>
- Anonim. (2019). *Rawa dan Tumpang sari Prioritas Utama Peningkatan Produksi Pangan Tahun 2019*. [www. tanamanpangan.pertanian.go.id/detil-konten/berita/156](http://www.tanamanpangan.pertanian.go.id/detil-konten/berita/156)
- Anonim. (2022a). *4 Syarat Tumbuh Jagung Agar Tumbuh Optimal*. <https://paktanidigital.com/artikel/syarat-tumbuh-jagung-agar-tumbuh-optimal/>
- Anonim. (2022b). *Budidaya Tanaman Kedelai*. <https://pertanian.ngawikab.go.id/2022/08/29/budidaya-tanaman-kedelai/#:~:text=Syarat Tumbuh,kurang dari 600 m dpl.>
- Arnon, D.I. (1949). Copper enzymes isolated chloroplasts, polyphenoloxidase in Beta vulgaris. *Plant Physiology*, 24(1), 1–15. <https://doi.org/10.2307/4118807>
- Arya, H., Singh, M.B., & Bhalla, P.L. (2021). Towards Developing Drought-smart Soybeans. *Frontiers in Plant Science*, 12 (October). <https://doi.org/10.3389/fpls.2021.750664>

- Ayisi, K.K., Putnam, D.H., Vance, C.P., Russelle, M.P., & Allan, D.L. (1997). Strip intercropping and nitrogen effects on seed, oil, and protein yields of canola and soybean. *Agronomy Journal*, 89(1), 23–29. <https://doi.org/10.2134/agronj1997.00021962008900010004x>
- Balai Penelitian Tanah. (2005). *Analisis kimia, Tanah, Tanaman, Air dan Pupuk*. Balai Penelitian dan Pengembangan Pertanian Departemen Pertanian. https://doi.org/10.30965/9783657766277_011
- Balai Penelitian Tanaman Aneka Kacang dan Umbi. (2016a). Kedelai 1918 – 2016. *Deskripsi Varietas Unggul Aneka Kacang Dan Umbi*.
- Balai Penelitian Tanaman Aneka Kacang dan Umbi. (2016b). Deskripsi Tanaman Kedelai Hitam (*Glycine max* L. Merr) Varietas Mallika. *Deskripsi Varietas Unggul Aneka Kacang Dan Umbi*, 86. <https://balitkabi.litbang.pertanian.go.id/>
- Banik, P., Sasmal, T., Ghosal, P.K., & Bagchi, D.K. (2000). Evaluation of mustard (*Brassica campestris* var. Toria) and legume intercropping under 1:1 and 2:1 row-replacement series systems. *Journal of Agronomy and Crop Science*, 185(1), 9–14. <https://doi.org/10.1046/j.1439-037X.2000.00388.x>
- Bataire, E. (2023). *Mixed cropping: advantages, disadvantages, and differences from intercropping (Tanam Campuran: Kelebihan, Kekurangan, dan Perbedaan Tumpangsari)*. <https://bivatec.com/blog/mixed-cropping-and-intercropping-in-agriculture>.
- Beets, W. (1982). *Multiple Cropping and Tropical Farming Systems*. Westview Press, Boulder.
- Belel, M.D., Halim, R.A., Rafii, M.Y., & Saud, H.M. (2014). Intercropping of Corn With Some Selected Legumes for Improved Forage Production: A Review. *Journal of Agricultural Science*, 6(3), 48–62. <https://doi.org/10.5539/jas.v6n3p48>
- Bellaloui, N., Bruns, H.A., Abbas, H.K., Mengistu, A., Fisher, D.K., & Reddy, K.N. (2015). Agricultural practices altered soybean seed protein, oil, fatty acids, sugars, and minerals in the Midsouth USA. *Frontiers in Plant Science*, 6 (February), 1–14. <https://doi.org/10.3389/fpls.2015.00031>
- Betencourt, E., Duputel, M., Colomb, B., Desclaux, D., & Hinsinger, P. (2012). Intercropping promotes the ability of durum wheat and chickpea to increase rhizosphere phosphorus availability in a low P soil. *Soil Biology and Biochemistry*, 46, 181–190. <https://doi.org/10.1016/j.soilbio.2011.11.015>
- Bing, L., & De-Ning, Q. (2015). Effects of shading on spatial distribution of flower and flower abscission in field-grown three soybeans in Northern China. *Emirates Journal of Food and Agriculture*, 27(8), 629–635. <https://doi.org/10.9755/ejfa.2015.04.016>
- Biszcak, W., Różyło, K., & Kraska, P. (2020). Yielding parameters, nutritional value of soybean seed and weed infestation in relay-strip intercropping system with buckwheat. *Acta Agriculturae Scandinavica Section B: Soil and Plant Science*, 70(8), 640–647. <https://doi.org/10.1080/09064710.2020.1831586>
- Blessing, D.J., Gu, Y., Cao, M., Cui, Y., Wang, X., & Asante-Badu, B. (2022). Overview of the advantages and limitations of maize-soybean intercropping in sustainable agriculture and future prospects: A review. *Chilean Journal of Agricultural Research*, 82(1), 177–188. <https://doi.org/10.4067/S0718->

58392022000100177

- Board, J.E., Kumudini, S., Omielan, J., Prior, E., & Kahlon, C.S. (2010). Yield response of soybean to partial and total defoliation during the seed-filling period. *Crop Science*, 50(2), 703–712. <https://doi.org/10.2135/cropsci2009.03.0128>
- Bouslama, M., Schapaugh, W.T.Jr. (1984). Stress Tolerance in Soybeans. I. Evaluation of Three Screening Techniques for Heat and Drought Tolerance. *CROP SCIENCE*, 24(933–937). .0011183X002400050026x
- BPS. (2022). *Luas panen, produksi, dan produktivitas padi menurut provinsi 2020-2022*. <https://www.bps.go.id/indicator/53/1498/2/luas-panen-produksi-dan-produktivitas-padi-menurut-provinsi.html>.
- Bucher, M. (2007). Functional biology of plant phosphate uptake at root and mycorrhiza interfaces. *New Phytologist*, 173(1), 11–26. <https://doi.org/10.1111/j.1469-8137.2006.01935.x>
- Cafaro La Menza, N., Monzon, J.P., Specht, J.E., & Grassini, P. (2017). Is soybean yield limited by nitrogen supply? *Field Crops Research*, 213 (August), 204–212. <https://doi.org/10.1016/j.fcr.2017.08.009>
- Cantarelli, L.D., Schuch, L.O.B., Rufino, C. de A., Tavares, L.C., & Vieira, J.F. (2015). Physiological seeds quality: Spatial distribution and variability among soybean plant population. *Bioscience Journal*, 31(2), 344–351. <https://doi.org/10.14393/bj-v31n2a2015-22274>
- Casal, J.J. (2013). Photoreceptor signaling networks in plant responses to shade. In *Annual Review of Plant Biology* (Vol. 64, pp. 403–427). <https://doi.org/10.1146/annurev-arplant-050312-120221>
- Chauser-Volfson, E., & Gutterman, Y. (1998). Content and distribution of anthrone C-glycosides in the South African arid plant species *Alloe mutabilis* growing in direct sunlight and in shade in the Negev Desert of Israel. *Journal of Arid Environments*, 40(4), 441–451. <https://doi.org/10.1006/jare.1998.0459>
- Chen, G., Chai, Q., Huang, G., Yu, A., Feng, F., Mu, Y., Kong, X., & Huang, P. (2015). Belowground Interspecies Interaction Enhances Productivity and Water Use Efficiency in Maize–Pea Intercropping Systems. *Crop Science*, 55(1), 420–428. <https://doi.org/10.2135/cropsci2014.06.0439>
- Cheng, B., Wang, L., Liu, R., Wang, W., Yu, R., Zhou, T., Ahmad, I., Raza, A., Jiang, S., Xu, M., Liu, C., Yu, L., Wang, W., Jing, S., Liu, W., & Yang, W. (2022). Shade-Tolerant Soybean Reduces Yield Loss by Regulating Its Canopy Structure and Stem Characteristics in the Maize–Soybean Strip Intercropping System. *Frontiers in Plant Science*, 13(March), 1–16. <https://doi.org/10.3389/fpls.2022.848893>
- Cho, J.W., Park, G.S., Yamakawa, T., & Ohga, S. (2005). Comparison of yield in Korean small seed soybean cultivars with main stem and branch production. *Journal of the Faculty of Agriculture, Kyushu University*, 50(2), 511–519. <https://doi.org/10.5109/4665>
- Choudhary, V.K., Dixit, A., & Chauhan, B.S. (2016). Resource-use maximisation through legume intercropping with maize in the eastern Himalayan region of India. *Crop and Pasture Science*, 67(5), 508–519. <https://doi.org/10.1071/CP15233>

- Da Rosa Ulguim, A., Agostinetto, D., De Oliveira, C., Ruchel, Q., Da Silva, J.D.G., Vargas, L., & Avila, L.A. (2017). Does competition between soybeans and Wild Poinsettia with low-level resistance or susceptibility to glyphosate affect physiology and secondary metabolism? *Semina:Ciencias Agrarias*, 38(3), 1133–1144. <https://doi.org/10.5433/1679-0359.2017v38n3p1133>
- Dangia, N., Jalata, Z., & Daba, G. (2021). Effects of Varieties and Population of Soybean Intercropped with Maize on Yield and Yield Components of Associated Crops. *Journal of Plant Sciences*, 9(4), 128. <https://doi.org/10.11648/j.jps.20210904.12>
- de Quadros, F.M., de Freitas, M.B., Simioni, C., Ferreira, C., & Stadnik, M.J. (2020). Redox status regulation and action of extra- and intravascular defense mechanisms are associated with bean resistance against *Fusarium oxysporum* f. sp. *phaseoli*. *Protoplasma*, 257(5), 1457–1472. <https://doi.org/10.1007/s00709-020-01521-0>
- Dewi, F.Q., Pradita F. (2022). Analisis indikasi potensi lahan daerah perkembangan kota Yogyakarta. In *Universitas Muhammadiyah Surakarta*.
- Du, Q., Zhou, L., Chen, P., Liu, X., Song, C., Yang, F., Wang, X., Liu, W., Sun, X., Du, J., Liu, J., Shu, K., Yang, W., & Yong, T. (2020). Relay-intercropping soybean with maize maintains soil fertility and increases nitrogen recovery efficiency by reducing nitrogen input. *Crop Journal*, 8(1), 140–152. <https://doi.org/10.1016/j.cj.2019.06.010>
- Egbe, M.O. & Osang, P.O. (2015). Intercrop Advantages of some Improved Sweet Potato + Soybean in Makurdi, Benue State, Nigeria. *International Letters of Natural Sciences*, 39, 28–39. <https://doi.org/10.18052/www.scipress.com/ilns.39.28>
- Egbe, O.M. (2010). *Effects of plant density of intercropped soybean with tall sorghum on competitive ability of soybean and economic yield at Otobi , Benue State , Nigeria*. 1(June), 1–10.
- Eskandari, H. (2012). Intercropping of Maize (*Zea mays*) with Cowpea (*Vigna Sinensis*) and Mungbean (*Vigna radiata*): Effect of Complementarity of Intercrop Components on Resource Consumption , Dry matter Production and. *Journal of Basic and Applied Scientific Research*, 2(1), 355–360.
- Eskandari, H., Hamid, A., & Alizadeh-Amraie, A. (2015). Development and maturation of sesame (*Sesamum indicum*) seeds under different water regimes. *Seed Science and Technology*, 43(2), 269–272. <https://doi.org/10.15258/sst.2015.43.2.03>
- Eslamizadeh, A., Kashani, A., Ata, S., Siyadat, A., Modhej, A., & Lak, S. (2015). Study of soybean forage at different planting dates intercropped with corn. *WALIA Journal*, 31(2008), 108–112.
- Evans, J.R., & Poorter, H. (2001). Photosynthetic acclimation of plants to growth irradiance: The relative importance of specific leaf area and nitrogen partitioning in maximizing carbon gain. *Plant, Cell and Environment*, 24(8), 755–767. <https://doi.org/10.1046/j.1365-3040.2001.00724.x>
- Fabre, F., & Planchon, C. (2000). Nitrogen nutrition, yield and protein content in soybean. *Plant Science*, 152(1), 51–58. [https://doi.org/10.1016/S0168-9452\(99\)00221-6](https://doi.org/10.1016/S0168-9452(99)00221-6)
- Fachruddin, L. (2000). *Budidaya kacang kacangan*. Kanisius, Yogyakarta.

- Fan, Y., Chen, J., Cheng, Y., Raza, M. A., Wu, X., Wang, Z., Liu, Q., Wang, R., Wang, X., Yong, T., Liu, W., Liu, J., Du, J., Shu, K., Yang, W., & Yang, F. (2018a). Effect of shading and light recovery on the growth, leaf structure, and photosynthetic performance of soybean in a maize-soybean relay-strip intercropping system. *PLoS ONE*, 13(5), 1–15. <https://doi.org/10.1371/journal.pone.0198159>
- Fan, Y., Li, S., Raza, M. A., Wang, Z., Wang, B., Zhang, J., Tan, X., Tan, T., Feng, L., Wu, X., Fan, Y., Li, S., Raza, M. A., Wang, Z., & Wang, B. (2020). Regulation morphological and architectural acclimation of soybean seedlings to shade Regulation morphological and architectural acclimation of soybean. *Research*, 155, 245–253.
- Farahani, H.A., Moaveni, P., Maroufi, K. (2011). Effect of Seed Size on Seedling Production in Wheat (*Triticum aestivum* L.). *Advances in Environmental Biology*, 5(7), 1711–1715.
- Farnham, D.E. (2001). Row spacing, plant density, and nitrogen effects on corn silage. *Agronomy Journal*, 93(3), 597–602. <https://doi.org/10.2134/agronj2001.933597x>
- Feng, L., Raza, M. A., Li, Z., Chen, Y., Khalid, M. H. Bin, Du, J., Liu, W., Wu, X., Song, C., Yu, L., Zhang, Z., Yuan, S., Yang, W., & Yang, F. (2019a). The influence of light intensity and leaf movement on photosynthesis characteristics and carbon balance of Soybean. *Frontiers in Plant Science*, 9(January), 1–16. <https://doi.org/10.3389/fpls.2018.01952>
- Feng, L., Raza, M.A., Chen, Y., Khalid, M.H. Bin, Meraj, T.A., Ahsan, F., Fan, Y., Du, J., Wu, X., Song, C., Liu, C., Bawa, G., Zhang, Z., Yuan, S., Yang, F., & Yang, W. (2019b). Narrow-wide row planting pattern improves the light environment and seed yields of intercrop species in relay intercropping system. *PLoS ONE*, 14(2), 1–19. <https://doi.org/10.1371/journal.pone.0212885>
- Fernandez, : G.C.J. (1992). Stress Tolerance Index- A new indicator of tolerance. *HortScience*, 27(6), 626d. [https://doi.org/https://doi.org/10.21273/HORTSCI.27\(6\).626d](https://doi.org/https://doi.org/10.21273/HORTSCI.27(6).626d)
- Ferreira, V.B., da Silva, T.T.C., Couto, S.R.M., & Srur, A.U.O.S. (2015). Total Phenolic Compounds and Antioxidant Activity of Organic Vegetables Consumed in Brazil. *Food and Nutrition Sciences*, 06(09), 798–804. <https://doi.org/10.4236/fns.2015.69083>
- Franklin, K.A. (2008). Shade avoidance. *New Phytologist*, 179(4), 930–944. <https://doi.org/10.1111/j.1469-8137.2008.02507.x>
- Fu Zhi., Li, Z., Chen, P., Qing, D., Ting, P., Chun, S., Xiao-chun, W., Wei-guo, L., Wen-yu, Y., Tai-wen, Y. (2019). Effects of maize-soybean relay intercropping on crop nutrient uptake and soil bacterial community. *Journal of Integrative Agriculture*, 18(9), 2006–2018. [https://doi.org/10.1016/S2095-3119\(18\)62114-8](https://doi.org/10.1016/S2095-3119(18)62114-8)
- Fuadi, N.A., Purwanto, M.Y.J., & Fajar, A. (2020). Soybean cultivation prospect based on crop water requirements and the agroclimatic zone in Jambi Province. *Jurnal Irigasi*, 15(2), 85–94. <https://doi.org/10.31028/ji.v15.i2.85-94>
- Gaju, O., DeSilva, J., Carvalho, P., Hawkesford, M.J., Griffiths, S., Greenland, A., & Foulkes, M.J. (2016). Leaf photosynthesis and associations with grain yield,

- biomass and nitrogen-use efficiency in landraces, synthetic-derived lines and cultivars in wheat. *Field Crops Research*, 193, 1–15. <https://doi.org/10.1016/j.fcr.2016.04.018>
- Gao, X., Wu, M., Xu, R., Wang, X., Pan, R., Kim, H.J., & Liao, H. (2014). Root interactions in a maize/soybean intercropping system control soybean soil-borne disease, red crown
- Gao, Y., Duan, A., Qiu, X., Liu, Z., Sun, J., Zhang, J., & Wang, H. (2010). Distribution of roots and root length density in a maize/soybean strip intercropping system. *Agricultural Water Management*, 98(1), 199–212. <https://doi.org/10.1016/j.agwat.2010.08.021>
- Gao, Y., Duan, A., Sun, J., Li, F., Liu, Z., Liu, H., & Liu, Z. (2009). Crop coefficient and water-use efficiency of winter wheat/spring maize strip intercropping. *Field Crops Research*, 111(1–2), 65–73. <https://doi.org/10.1016/j.fcr.2008.10.007>
- Gardner, F.P, Pearce R.B., & Mitchell, R. (1991). *Fisiologi tanaman budidaya (edisi terjemahan)*. UI-Press. Jakarta.
- Gavuzzi, P., Rizza, F., Palumbo, M., Campanile, R.G., Ricciardi, G.L., Borghi, B., Mulino, V., Angelo, N.S., & Section, I.S.C. (1997). *Evaluation of field and laboratory predictors of drought and heat tolerance in winter cereals. Canadian Journal of Plant Science*. 77(4): 523–531. <https://doi.org/10.4141/P96-130>
- Ghassemi-Golezani, K., Tajbakhsh, Z., & Raey, Y. (2011). Seed development and quality in maize cultivars. *Notulae Botanicae Horti Agrobotanici Cluj-Napoca*, 39(1), 178–182. <https://doi.org/10.15835/nbha3915713>
- Ghosh, P.K. (2004). Growth, yield, competition and economics of groundnut/cereal fodder intercropping systems in the semi-arid tropics of India. *Field Crops Research*, 88(2–3), 227–237. <https://doi.org/10.1016/j.fcr.2004.01.015>
- Ghosh, P.K., Manna, M.C., Bandyopadhyay, K.K., Ajay, Tripathi, A.K., Wanjari, R. H., Hati, K.M., Misra, A.K., Acharya, C.L., & Subba Rao, A. (2006). Interspecific interaction and nutrient use in soybean/sorghum intercropping system. *Agronomy Journal*, 98(4), 1097–1108. <https://doi.org/10.2134/agronj2005.0328>
- Ginting, E., Harsono, A., Elisabeth, D.A.A., Rahmianna, A.A., Utomo, J.S., & Harnowo, D. (2023). Yield, seed quality, and financial feasibility of soybean intercropped with maize in the alfisol dry land. *Applied Ecology and Environmental Research*, 21(1), 323–350. https://doi.org/10.15666/aeer/2101_323350
- Goldflus, F., Ceccantini, M.L., & Santos, W. (2006). Amino acid content of soybean samples collected in different Brazilian States - Harvest 2003/2004. *Revista Brasileira de Ciencia Avicola*, 8(2), 105–111. <https://doi.org/10.1590/S1516-635X2006000200006>
- Gommers, C.M.M., Visser, E.J.W., Onge, K.R.S., Voesenek, L.A.C.J. & Pierik, R. (2013). Shade tolerance: When growing tall is not an option. *Trends in Plant Science*, 18(2), 65–71. <https://doi.org/10.1016/j.tplants.2012.09.008>
- Gong, W., Qi, P., Du, J., Sun, X., Wu, X., Song, C., Liu, W., Wu, Y., Yu, X., Yong, T., Wang, X., Yang, F., Yan, Y., & Yang, W. (2014). Transcriptome analysis of shade-induced inhibition on leaf size in relay intercropped soybean. *PLoS*

ONE, 9(6). <https://doi.org/10.1371/journal.pone.0098465>

- Gong, W.Z., Jiang, C.D., Wu, Y.S., Chen, H.H., Liu W.Y., & Wong. Y.Y. (2015). Tolerance vs. avoidance: two strategies of soybean (*Glycine max*) seedlings in response to shade in intercropping. *Photosynthetica*, 53(2), 259–268. <https://doi.org/10.1007/s11099-015-0103-8>
- Gu, J., Zhou, Z., Li, Z., Chen, Y., Wang, Z., & Zhang, H. (2017). Rice (*Oryza sativa* L.) with reduced chlorophyll content exhibit higher photosynthetic rate and efficiency, improved canopy light distribution, and greater yields than normally pigmented plants. *Field Crops Research*, 200, 58–70. <https://doi.org/10.1016/j.fcr.2016.10.008>
- Hafid, H., Syaiful, S.A., Kaimuddin, Fattah, A., & Djufry, F. (2021). The effect of the number of rows and varieties of soybean on growth and yield in intercropping with corn. *IOP Conference Series: Earth and Environmental Science*, 648(1). <https://doi.org/10.1088/1755-1315/648/1/012204>
- Hairmansis, A., & Jamil, A.L.I. (2017). *Variability of upland rice genotypes response to low light intensity*. 18(3), 1122–1129. <https://doi.org/10.13057/biodiv/d180333>
- Hale, M.G., Orcutt, D.M., Thompson, L.K (1987). *The physiology of plants under stress*. John Wiley and Sons, New York.
- Hamburdă, S.B., Teliban, G.C., Munteanu, N., & Stoleru, V. (2016). Effect of intercropping system on the quality and quantity of runner bean (*Phaseolus coccineus* L.). *Notulae Botanicae Horti Agrobotanici Cluj-Napoca*, 44(2), 613–618. <https://doi.org/10.15835/nbha44210260>
- Hamburdă, S.B., Munteanu, N., & Teliban, G.C. (2015). Intercropping – a successful system for runner bean (*Phaseolus coccineus* L) crop. *Bulletin of University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca Horticulture* 72(1). <https://doi.org/10.15835/buasvmcn-hort>
- Hammond, J.P., Broadley, M.R., & White, P.J. (2004). Genetic responses to phosphorus deficiency. *Annals of Botany*, 94(3), 323–332. <https://doi.org/10.1093/aob/mch156>
- Handriawan A., Respatie, D.W., & Tohari, T. (2016). Pengaruh intensitas naungan terhadap pertumbuhan dan hasil tiga kultivar kedelai (*Glycine max* (L.). *Vegetalika*, 5(3), 1–14.
- Hardman, L.L., & Gunsolus, J.L. (1991). *Corn growth and development & management information for replant decisions*. University of Minnesota. Agricultural Extension Service. <https://doi.org/AG-FO>; no. 5700
- Hardy, R.W.F., Holsten, R.D., Jackson, E.K., & Burns, R.C. (1968). The acetylene - ethylene assay for N₂ fixation: Laboratory and field evaluation '. *Plant Physiol.*, 43, 1185–1207.
- Harnowo, D., Hidayat, J.R., Suyanto. (2010). *Kebutuhan dan teknologi produksi benih kedelai, Dalam: Kedelai: Teknik produksi dan pengembangan*. Badan Litbang Pertanian. Penerbit Balai Pustaka. Hal. 383–418.
- Harsono, A., Elisabeth, D.A.A., Muzaiyanah, S., & Rianto, S.A. (2020). Soybean-maize intercropping feasibility under drought-prone area in East Java, Indonesia. *Biodiversitas*, 21(8), 3744–3754. <https://doi.org/10.13057/biodiv/d210842>

- Hartiko, H., Nur, A.M., Isbandi, D., Hartiko, H. (1987). Faktor-faktor yang mempengaruhi aktivitas nitrat reduktase in vivo daun kopi robusta. *Ilmu Pertanian*, 4(4), 193–203.
- Hasanah, Y., Nisa, T.C., Hapsoh & Hanum, H. (2015). Isoflavone content of soybean [*Glycine max* (L.) Merr.] cultivars with different nitrogen sources and growing season under dry land conditions. *Journal of Agriculture and Environment for International Development-JAEID*, 2015(1), 5–17. <https://doi.org/10.12895/jaeid.20151.216>
- Hatzig, S.V., Frisch, M., Breuer, F., Nesi, N., Ducournau, S., Wagner, M.H., Leckband, G., Abbadi, A., & Snowdon, R.J. (2015). Genome-wide association mapping unravels the genetic control of seed germination and vigor in *Brassica napus*. *Frontiers in Plant Science*, 6(APR), 1–13. <https://doi.org/10.3389/fpls.2015.00221>
- Heimler, D., Vignolini, P., Dini, M.G., & Romani, A. (2005). Rapid tests to assess the antioxidant activity of *Phaseolus vulgaris* L. dry beans. *Journal of Agricultural and Food Chemistry*, 53(8), 3053–3056. <https://doi.org/10.1021/jf049001r>
- Henzler, T., & Steudle, E. (2000). Transport and metabolic degradation of hydrogen peroxide in chara corallina: Model calculations and measurements with the pressure probe suggest transport of H₂O₂ across water channels. *Journal of Experimental Botany*, 51(353), 2053–2066. <https://doi.org/10.1093/jexbot/51.353.2053>
- Hidayat, I.M., Kirana, R., Gaswanto R., Kusmana, H. (2006). *Petunjuk teknis budidaya dan produksi benih beberapa sayuran indigenous*. Balai Penelitian Tanaman Sayuran, Lembang, Bandung, Indonesia
- Hörak, H., Kollist, H., & Merilo, E. (2017). Fern stomatal responses to ABA and CO₂ depend on species and growth conditions. *Plant Physiology*, 174(2), 672–679. <https://doi.org/10.1104/pp.17.00120>
- Hu, B., Wu, P., Liao, C.Y., Zhang, W.P., & Ni, J.J. (2001). QTLs and epistasis underlying activity of acid phosphatase under phosphorus sufficient and deficient condition in rice (*Oryza sativa* L.). *Plant and Soil*, 230(1), 99–105. <https://doi.org/10.1023/A:1004809525119>
- Huang, C., Liu, Q., Heerink, N., Stomph, T., Li, B., Liu, R., Zhang, H., Wang, C., Li, X., Zhang, C., Van Der Werf, W., & Zhang, F. (2015). Economic performance and sustainability of a novel intercropping system on the North China plain. *PLoS ONE*, 10(8), 1–16. <https://doi.org/10.1371/journal.pone.0135518>
- Ibrahim Abdel-Wahab, T. (2016). Response of some soybean cultivars to low light intensity under different intercropping patterns with maize. *International Journal of Applied Agricultural Sciences*, 2(2), 21. <https://doi.org/10.11648/j.ijaas.20160202.11>
- Ibrahim, M.H., & Jaafar, H.Z.E. (2012). Primary, secondary metabolites, H₂O₂, malondialdehyde and photosynthetic responses of *Orthosiphon stamineus* benth. to different irradiance levels. *Molecules*, 17(2), 1159–1176. <https://doi.org/10.3390/molecules17021159>
- Ijoyah, M.O., & Fanen, F.T. (2012). Effects of different cropping pattern on performance of maize-soybean mixture in Makurdi, Nigeria. *Scientific Journal*

of Crop Science, 1(2), 39–47.

- Ikazaki, K., Nagumo, F., Simporé, S., Iseki, K., & Barro, A. (2020). Effects of intercropping component of conservation agriculture on sorghum yield in the Sudan Savanna. *Soil Science and Plant Nutrition*, 66(5), 755–762. <https://doi.org/10.1080/00380768.2020.1816444>
- Ilyas, S. (2012). *Teknologi Benih : Teori dan Hasil-Hasil Penelitian*. IPB Press. Bogor.
- Imas, P., & Magen, H. (2007). Role of potassium nutrition in balanced fertilization for soybean yield and quality-Global perspective. *World*, 92(220.55), 2.38.
- Iqbal, M.A., Hamid, A., Ahmad, T., Siddiqui, M.H., Hussain, I., Ali, S., Ali, A., & Ahmad, Z. (2019). Forage sorghum-legumes intercropping: Effect on growth, yields, nutritional quality and economic returns. *Bragantia*, 78(1), 82–95. <https://doi.org/10.1590/1678-4499.2017363>
- Iqbal, M.A., Iqbal, A., & Abbas, R.N. (2018). Spatio-temporal reconciliation to lessen losses in yield and quality of forage soybean (*Glycine max* L.) in soybean-sorghum intercropping systems. *Bragantia*, 77(2), 283–291. <https://doi.org/10.1590/1678-4499.2017043>
- Iqbal, N., Hussain, S., Ahmed, Z., Yang, F., Wang, X., Liu, W., Yong, T., Du, J., Shu, K., Yang, W., & Liu, J. (2019a). Comparative analysis of maize–soybean strip intercropping systems: a review. *Plant Production Science*, 22(2), 131–142. <https://doi.org/10.1080/1343943X.2018.1541137>
- Jiao, N., Wang, J., Ma, C., Zhang, C., Guo, D., Zhang, F., & Jensen, E.S. (2021). The importance of aboveground and belowground interspecific interactions in determining crop growth and advantages of peanut/maize intercropping. *Crop Journal*, 9(6), 1460–1469. <https://doi.org/10.1016/j.cj.2020.12.004>
- Jin, Y., He, J., Zhu, Y., & Siddique, K.H.M. (2022). Nodule formation and Nitrogen use efficiency are important for soybean to adapt to water and P deficit conditions. *Agriculture (Switzerland)*, 12(9). <https://doi.org/10.3390/agriculture12091326>
- Jun-bo, D.U., Tian-fu, H.A.N., Jun-yi, G.A.I., Tai-wen, Y., Xin, S.U.N., Xiao-chun, W., & Feng, Y. (2018). Maize-soybean strip intercropping : Achieved a balance between high productivity and sustainability. *Journal of Integrative Agriculture*, 17(4), 747–754. [https://doi.org/10.1016/S2095-3119\(17\)61789-1](https://doi.org/10.1016/S2095-3119(17)61789-1)
- Kakiuchi, J., & Kobata, T. (2006). The relationship between dry matter increase of seed and shoot during the seed-filling period in three kinds of soybeans with different growth habits subjected to shading and thinning. *Plant Production Science*, 9(1), 20–26. <https://doi.org/10.1626/pps.9.20>
- Kalve, S., Fotschki, J., Beeckman, T., Vissenberg, K., & Beemster, G.T.S. (2014). Three-dimensional patterns of cell division and expansion throughout the development of *Arabidopsis thaliana* leaves. *Journal of Experimental Botany*, 65(22), 6385–6397. <https://doi.org/10.1093/jxb/eru358>
- Kamara, A.Y., Tofa, A.I., Ademulegun, T., Solomon, R., Shehu, H., Kamai, N., & Omoigui, L. (2019). Maize-soybean intercropping for sustainable intensification of cereal-legume cropping systems in northern Nigeria. *Experimental Agriculture*, 55(1), 73–87. <https://doi.org/10.1017/S0014479717000564>

- Kamil, J. (1979). *Teknologi Benih I*. Angkasa Raya, Padang.
- Kaya, M., Şanlı, A., & Tonguç, M. (2010). Effect of sowing dates and seed treatments on yield, some yield parameters and protein content of chickpea (*Cicer arietinum* L.). *African Journal of Biotechnology*, 9(25), 3833–3839. <https://doi.org/10.5897/AJB10.268>
- Keller, C.P. (2017). Leaf expansion in Phaseolus: transient auxin-induced growth increase. *Physiol Plant*. 130(4), 580–589. <https://doi.org/10.1111/j.1399-3054.2007.00916.x>.
- Khalid, M.H.B., Raza, M.A., Yu, H.Q., Sun, F.A., Zhang, Y.Y., Lu, F.Z., Si, L., Iqbal, N., Khan, I., Fu, F.L., & Li, W.C. (2019). Effect of shade treatments on morphology, photosynthetic and chlorophyll fluorescence characteristics of soybeans (*Glycine max* L. Merr.). *Applied Ecology and Environmental Research*, 17(2), 2551–2569. https://doi.org/10.15666/aeer/1702_25512569
- Khaliliaqdam, N., Soltani, A., Latifi, N., & Far, F.G. (2012). Seed vigor and field performance of soybean seedlots case study: northern areas of Iran. *J. Agric. & Environ. Sci*, 12(2), 262–268.
- Khatri, N., Dahal, K.R., Amgain, L.P., & Karki, T.B. (2014). Productivity and economic assessment of maize and soybean intercropping under various tillage and residue levels in Chitwan, Nepal. *World Journal of Agricultural Research*, 2(6A), 6–12. <https://doi.org/10.12691/wjar-2-6a-2>
- Khonde, P., Tshiabukole, K., Kankolongo, M., Hauser, S., Djamba, M., Vumilia, K., & Nkongolo, K. (2018). Evaluation of yield and competition indices for intercropped eight maize varieties, soybean and cowpea in the zone of savanna of south-west RD Congo. *OALib*, 05(01), 1–18. <https://doi.org/10.4236/oalib.1103746>
- Kichey, T., Hirel, B., Heumez, E., Dubois, F., & Le Gouis, J. (2007). In winter wheat (*Triticum aestivum* L.), post-anthesis nitrogen uptake and remobilisation to the grain correlates with agronomic traits and nitrogen physiological markers. *Field Crops Research*, 102(1), 22–32. <https://doi.org/10.1016/j.fcr.2007.01.002>
- Kızıl Aydemir, S. (2018). Maize and soybean intercropping under different seed rates of soybean under ecological condition of Bilecik, Turkey. *International Journal of Environmental Science and Technology*, 16(9), 5163–5170. <https://doi.org/10.1007/s13762-018-1986-2>
- Kızılsimşek, S.K.A.M. (2018). Assessing yield and feed quality of intercropped sorghum and soybean in different planting patterns and in different ecologies. *International Journal of Environmental Science and Technology*, Akunda 2001. <https://doi.org/10.1007/s13762-018-1948-8>
- Koesrini dan Williarni, E. (2004). Keragaan hasil dan daya toleransi genotip kedelai di lahan sulfat masam. *Buletin Agronomi*, 32(32), 33–38.
- Kozuka, T., Horiguchi, G., Kim, G. T., Ohgishi, M., Sakai, T., & Tsukaya, H. (2005). The different growth responses of the *Arabidopsis thaliana* leaf blade and the petiole during shade avoidance are regulated by photoreceptors and sugar. *Plant and Cell Physiology*, 46(1), 213–223. <https://doi.org/10.1093/pcp/pci016>
- Krisdiana, R. (2013). *Penyebaran varietas unggul kedelai dan dampaknya terhadap ekonomi perdesaan*. Balitkabi 2012, 61–69.

- Krisnawati, A., & Adie, M.M. (2015). Selection of soybean genotypes by seed size and its prospects for industrial raw material in Indonesia. *Italian Oral Surgery*, 3, 355–363. <https://doi.org/10.1016/j.profoo.2015.01.039>
- Krisnawati, A., Yusnawan, E., Elisabeth, D.A.A., Kristiono, A., Wahyuningsih, S., Uge, E.AK. (2021). *Ringkasan Laporan Tahunan 2021*. Balai Penelitian Tanaman Aneka Kacang dan Umbi. www.balitkabi.litbang.pertanian.go.id
- Kristiono, A. & Muzaiyanah, S. (2021). Response of corn-soybean intercropping to fertilizer packages in dry land with dry climate. *Planta Tropika: Jurnal Agrosains (Journal of Agro Science)*, 9(2), 100–108. <https://doi.org/10.18196/pt.v9i2.4378>
- Kumar, A., Rosinger, C., Chen, H., Protic, S., Bonkowski, M., & Temperton, V.M. (2021). Gone and forgotten: facilitative effects of intercropping combinations did not carry over to affect barley performance in a follow-up crop rotation. *Plant and Soil*, 467(1–2), 405–419. <https://doi.org/10.1007/s11104-021-05104-7>
- Lemos, O., Filho, D.M., Sedyama, C.S., Moreira, M.A., & Reis, M.S. (2004). Grain yield and seed quality of soybean selected for high protein content. 1, 445–450.
- Lestari, A.P., Sopandie, D., & Aswidinnoor, H. (2019). Estimation for stress tolerance indices of rice genotypes in low Nitrogen condition. 52, 180–190.
- Li, B., Krumbein, A., Neugart, S., Li, L., & Schreiner, M. (2012). Mixed cropping with maize combined with moderate UV-B radiations lead to enhanced flavonoid production and root growth in faba bean. *Journal of Plant Interactions*, 7(4), 333–340. <https://doi.org/10.1080/17429145.2012.714407>
- Li, B., Li, Y.Y., Wu, H.M., Zhang, F.F., Li, C.J., Li, X.X., Lambers, H., & Li, L. (2016). Root exudates drive interspecific facilitation by enhancing nodulation and N₂ fixation. *Proceedings of the National Academy of Sciences of the United States of America*, 113(23), 6496–6501. <https://doi.org/10.1073/pnas.1523580113>
- Li, L., Sun, J., Zhang, F., Guo, T., Bao, X., Smith, F.A., & Smith, S.E. (2006). Root distribution and interactions between intercropped species. *Oecologia*, 147(2), 280–290. <https://doi.org/10.1007/s00442-005-0256-4>
- Li, L., Sun, J., Zhang, F., Li, X., Yang, S., & Rengel, Z. (2001). Wheat/maize or wheat/soybean strip intercropping I. Yield advantage and interspecific interactions on nutrients. *Field Crops Research*, 71(2), 123–137. [https://doi.org/10.1016/S0378-4290\(01\)00156-3](https://doi.org/10.1016/S0378-4290(01)00156-3)
- Li, L., Tilman, D., Lambers, H., & Zhang, F.S. (2014). Plant diversity and overyielding: Insights from belowground facilitation of intercropping in agriculture. *New Phytologist*, 203(1), 63–69. <https://doi.org/10.1111/nph.12778>
- Li, T., Liu, L.N., Jiang, C.D., Liu, Y.J., & Shi, L. (2014). Effects of mutual shading on the regulation of photosynthesis in field-grown sorghum. *Journal of Photochemistry and Photobiology B: Biology*, 137, 31–38. <https://doi.org/10.1016/j.jphotobiol.2014.04.022>
- Li, T., Liu, Y., Shi, L., & Jiang, C. (2015). Systemic regulation of photosynthetic function in field-grown sorghum. *Plant Physiology and Biochemistry*, 94, 86–94. <https://doi.org/10.1016/j.plaphy.2015.05.008>

- Li, X., Mu, Y., Cheng, Y., Liu, X., & Nian, H. (2013). Effects of intercropping sugarcane and soybean on growth, rhizosphere soil microbes, nitrogen and phosphorus availability. *Acta Physiologiae Plantarum*, 35(4), 1113–1119. <https://doi.org/10.1007/s11738-012-1148-y>
- Lingga, G., Purwanti, S., Toekidjo, T. (2015). Hasil dan kualitas benih kacang hijau (*Vigna radiata* (L.) Wilczek) tumpangsari barisan dengan jagung manis (*Zea mays* kelompok Saccharata). *Vegetalika*, 4(2), 39–47.
- Liu, J., Qin, W. ting, Wu, H. jun, Yang, C. qiong, Deng, J. cai, Iqbal, N., Liu, W. guo, Du, J. bo, Shu, K., Yang, F., Wang, X. chun, Yong, T. wen, & Yang, W. yu. (2017a). Metabolism variation and better storability of dark-versus light-coloured soybean (*Glycine max* L. Merr.) seeds. *Food Chemistry*, 223, 104–113. <https://doi.org/10.1016/j.foodchem.2016.12.036>
- Liu, J., Yang, C.Q., Zhang, Q., Lou, Y., Wu, H. J., Deng, J.C., Yang, F., & Yang, W. Y. (2016). Partial improvements in the flavor quality of soybean seeds using intercropping systems with appropriate shading. *Food Chemistry*, 207, 107–114. <https://doi.org/10.1016/j.foodchem.2016.03.059>
- Liu, T., Gu, L., Dong, S., Zhang, J., Liu, P., & Zhao, B. (2015). Optimum leaf removal increases canopy apparent photosynthesis, ¹³C-photosynthate distribution and grain yield of maize crops grown at high density. *Field Crops Research*, 170, 32–39. <https://doi.org/10.1016/j.fcr.2014.09.015>
- Liu, W. guo, Ren, M. lu, Liu, T., Du, Y. li, Zhou, T., Liu, X. ming, Liu, J., Hussain, S., & Yang, W. yu. (2018). Effect of shade stress on lignin biosynthesis in soybean stems. *Journal of Integrative Agriculture*, 17(7), 1594–1604. [https://doi.org/10.1016/S2095-3119\(17\)61807-0](https://doi.org/10.1016/S2095-3119(17)61807-0)
- Liu, W., Zou, J., Zhang, J., Yang, F., Wan, Y., & Yang, W. (2015). Evaluation of soybean (*Glycine max*) stem vining in maize-soybean relay strip intercropping system. *Plant Production Science*, 18(1), 69–75. <https://doi.org/10.1626/pps.18.69>
- Liu, X., Jin, J., Wang, G., & Herbert, S.J. (2008). Soybean yield physiology and development of high-yielding practices in Northeast China. *Field Crops Research*. 105, 157–171. <https://doi.org/10.1016/j.fcr.2007.09.003>
- Liu, X., Rahman, T., Song, C., Su, B., Yang, F., Yong, T., Wu, Y., Zhang, C., & Yang, W. (2017b). Changes in light environment, morphology, growth and yield of soybean in maize-soybean intercropping systems. *Field Crops Research*, 200, 38–46. <https://doi.org/10.1016/j.fcr.2016.10.003>
- Liu, X., Rahman, T., Song, C., Yang, F., Su, B., Cui, L., Bu, W., & Yang, W. (2018a). Relationships among light distribution, radiation use efficiency and land equivalent ratio in maize-soybean strip intercropping. *Field Crops Research*, 224(July 2017), 91–101. <https://doi.org/10.1016/j.fcr.2018.05.010>
- Liu, X., Rahman, T., Song, C., Yang, F., Su, B., Cui, L., Bu, W., & Yang, W. (2018b). Relationships among light distribution, radiation use efficiency and land equivalent ratio in maize-soybean strip intercropping. *Field Crops Research*, 224(July 2017), 91–101. <https://doi.org/10.1016/j.fcr.2018.05.010>
- Liu, X., Rahman, T., Yang, F., Song, C., Yong, T., Liu, J., Zhang, C., & Yang, W. (2017). PAR Interception and utilization in different maize and soybean intercropping patterns. *PLoS ONE*, 12(1), 1–17. <https://doi.org/10.1371/journal.pone.0169218>

- Liu, Y. C., Qin, X. M., Xiao, J. X., Tang, L., Wei, C. Z., Wei, J. J., & Zheng, Y. (2017). Intercropping influences component and content change of flavonoids in root exudates and nodulation of faba bean. *Journal of Plant Interactions*, 12(1), 187–192. <https://doi.org/10.1080/17429145.2017.1308569>
- Liu, Y., Yin, X., Xiao, J., Tang, L., & Zheng, Y. (2019). Interactive influences of intercropping by nitrogen on flavonoid exudation and nodulation in faba bean. *Scientific Reports*, 9(1), 1–11. <https://doi.org/10.1038/s41598-019-41146-9>
- López-Bucio, J., Cruz-Ramírez, A., & Herrera-Estrella, L. (2003). The role of nutrient availability in regulating root architecture. *Current Opinion in Plant Biology*, 6(3), 280–287. [https://doi.org/10.1016/S1369-5266\(03\)00035-9](https://doi.org/10.1016/S1369-5266(03)00035-9)
- Luo, K., Xie, C., Yuan, X., Liu, S., Chen, P., Du, Q., Zheng, B., Fu, Z., Wang, X., Yong, T., & Yang, W. (2023). Biochar and biofertilizer reduced nitrogen input and increased soybean yield in the maize soybean relay strip intercropping system. *BMC Plant Biology*, 23(1), 1–10. <https://doi.org/10.1186/s12870-023-04058-5>
- Luo, Y., Tang, Y., Zhang, X., Li, W., Chang, Y., Pang, D., Xu, X., Li, Y., & Wang, Z. (2018). Interactions between cytokinin and nitrogen contribute to grain mass in wheat cultivars by regulating the flag leaf senescence process. *Crop Journal*, 6(5), 538–551. <https://doi.org/10.1016/j.cj.2018.05.008>
- Lv, Y., Francis, C., Wu, P., Chen, X., & Zhao, X. (2014). Maize-soybean intercropping interactions above and below ground. *Crop Science*, 54(3), 914–922. <https://doi.org/10.2135/cropsci2013.06.0403>
- Mamun, M.A.AI, Julekha, Sarker, U., Mannan, M.A., Rahman, M.M., Karim, M.A., Ercisli, S., Marc, R.A., & Golokhvast, K.S. (2022). Application of potassium after waterlogging improves quality and productivity of soybean seeds. *Life*, 12(11). <https://doi.org/10.3390/life12111816>
- Manceur, A. M., Boland, G.J., Thevathasan, N.V., & Gordon, A.M. (2009). Dry matter partitions and specific leaf weight of soybean change with tree competition in an intercropping system. *Agroforestry System*. 76, 295–301. <https://doi.org/10.1007/s10457-008-9181-y>
- Mariotti, M., Masoni, A., Ercoli, L., & Arduini, I. (2009). Above- and below-ground competition between barley, wheat, lupin and vetch in a cereal and legume intercropping system. *Grass and Forage Science*, 64(4), 401–412. <https://doi.org/10.1111/j.1365-2494.2009.00705.x>
- Marschner, P. (2012). Marschner's mineral nutrition of higher plants. In *Mineral nutrition of higher plants. (Third Edition)*, Academic Press,
- Mascarenhas, H.A.A., Tanaka, R.T., Wutke, E.B., & Braga, N.R., & de Miranda, M.A.C. (2004). Potassium for soybeans. *Better Crops*. 88(3), 26–27.
- Mawarni, L., Nisa, T.C., Napitupulu, J.A., & Karyudi. (2019). Determination of leaf status of soybean varieties on shading: chlorophyll and chloroplast. *Biodiversitas Journal of Biological Diversity*, 20(2), 615–620. <https://doi.org/10.13057/biodiv/d200243>
- McWilliams, D.A., Berglund, D.R., Endres, G.J. (1999). *Corn growth and management quick guide*. https://library.ndsu.edu/ir/bitstream/handle/10365/9112/A1173_1999.pdf?sequence=1&isAllowed=y.
- Meng, L., Zhang, A., Wang, F., Han, X., Wang, D., & Li, S. (2015). Arbuscular

- mycorrhizal fungi and rhizobium facilitate nitrogen uptake and transfer in soybean/maize intercropping system. *Frontiers in Plant Science*, 6(May), 1–10. <https://doi.org/10.3389/fpls.2015.00339>
- Mi, Z., Huang, Y., Gan, H., Zhou, W., Flynn, D.F.B., & He, J.S. (2015). Leaf P increase outpaces leaf N in an inner Mongolia grassland over 27 years. *Biology Letters*, 11(1), 10–14. <https://doi.org/10.1098/rsbl.2014.0981>
- Kostić, M., Balešević-Tubić, S., Tatić, M., Đorđević V., Lončarević, V., Đukić, V., A.I. (2013). Soybean seed germination and initial seedling growth as affected by seed size. *Journal on Processing and Energy in Agriculture*, 17(3), 127–129. <http://scindeks-clanci.ceon.rs/data/pdf/1821-4487/2013/1821-44871303127K.pdf>
- Mollasadeghi, V. (2013). Evaluation of drought tolerance indices bread wheat genotypes in end-season drought stress conditions. *Journal of Biology and Today's World*, 2(2), 43–47. <https://doi.org/10.15412/j.jbtw.01020205>
- Mollasadeghi, V., Aghahasanbeyglo, A.A., & Masoumzadeh, B.M., & Asghari, A.M. (2013). Evaluation of drought tolerance of bread wheat genotypes by use of stress tolerance indices. *International Journal of Farming and Allied Sciences*. 2, (S): 1233–1236.
- Monzon, J.P., Mercau, J.L., Andrade, J.F., Caviglia, O.P., Cerrudo, A.G., Cirilo, A.G., Vega, C.R.C., Andrade, F.H., & Calviño, P.A. (2014). Maize-soybean intensification alternatives for the Pampas. *Field Crops Research*, 162, 48–59. <https://doi.org/10.1016/j.fcr.2014.03.012>
- Mousavi, S.R., & Eskandari, H. (2011). A general overview on intercropping and its advantages in sustainable agriculture. *Journal of Applied Environment and Biological Sciences*. 1(11), 482–486.
- Muhadjir, F. (1998). *Karakteristik tanaman jagung*. Badan Penelitian dan Pengembangan Pertanian. Bogor.
- Muñoz-Huerta, R.F., Guevara-Gonzalez, R.G., Contreras-Medina, L.M., Torres-Pacheco, I., Prado-Olivarez, J., & Ocampo-Velazquez, R.V. (2013). A review of methods for sensing the nitrogen status in plants: Advantages, disadvantages and recent advances. *Sensors (Switzerland)*, 13(8), 10823–10843. <https://doi.org/10.3390/s130810823>
- Muoneke, C.O., Ogwuche, M.A.O., & Kalu, B.A. (2007). Effect of maize planting density on the performance of maize / soybean intercropping system in a guinea savannah agroecosystem. *Journal of Agricultural Research*, 2 (December), 667–677.
- Naik, M., Sumathi, V., & Kadiri, L. (2017). Response of optimum nitrogen rate in maize with legume intercropping system. *SAARC Journal of Agriculture*, 15(1), 139–148. <https://doi.org/10.3329/sja.v15i1.33158>
- Nasar, J., Zhao, C.J., Khan, R., Gul, H., Gitari, H., Shao, Z., Abbas, G., Haider, I., Iqbal, Z., Ahmed, W., Rehman, R., Liang, Q.P., Zhou, X.B., & Yang, J. (2023). Maize-soybean intercropping at optimal N fertilization increases the N uptake, N yield and N use efficiency of maize crop by regulating the N assimilatory enzymes. *Frontiers in Plant Science*, 13(January), 1–15. <https://doi.org/10.3389/fpls.2022.1077948>
- Nazari, L., Dehghanian, E., Estakhr, A., Khazaei, A., & Sorkhilalehloo, B., & Abbasi, M.R. (2021). *Introduction of the best criterion for evaluation of*

tolerance to drought stress in sorghum's genotypes. Acta agriculturae Slovenica, 117 (4): 1-13. <http://dx.doi.org/10.14720/aas.2021.117.4.2176>

- Ndakidemi, P.A., Dakora, F.D., Nkonya, E.M., Ringo, D., & Mansoor, H. (2006). Yield and economic benefits of common bean (*Phaseolus vulgaris*) and soybean (*Glycine max*) inoculation in northern Tanzania. *Australian Journal of Experimental Agriculture*, 46(4), 571–577. <https://doi.org/10.1071/EA03157>
- Nizar, A., Purnomo, D., & Indraningsih, B.R. (2017). Pengujian beberapa varietas kedelai pada sistem tumpang sari kedelai dan tebu terhadap produksi kedelai. *Jurnal Triton*, 8(1), 77–84.
- Nourbakhsh, F., Koocheki, A., & Nassiri, M. (2018). Investigation of biodiversity and some of the ecosystem services in the intercropping of corn, soybean and marshmallow. *International Journal of Plant Production*, 0123456789. <https://doi.org/10.1007/s42106-018-0032-0>
- Nugrahaeni, N., Taufiq, A., & Utomo, J.S. (2017). *Bunga rampai teknik produksi benih kedelai*. IAARD Press. Jakarta
- Nugraheni, N., Sundari, T., Marwoto, Kariyasa I.K., Widiarta I.N., Harnowo, D. (2013). *Pedoman Umum Produksi dan Distribusi benih Sumber Kedelai* (p. 37). Badan Penelitian dan Pengembangan Pertanian. ISBN 978-602-1280-04-1. http://balitkabi.litbang.pertanian.go.id/wp-content/uploads/2015/04/Pedum_BS_Delet_Kirim-web-1.pdf
- Nyoki, D., & Ndakidemi, P.A. (2018). Yield response of intercropped soybean and maize under rhizobia (*Bradyrhizobium japonicum*) inoculation and P and K fertilization. *Communications in Soil Science and Plant Analysis*, 49(10), 1168–1185. <https://doi.org/10.1080/00103624.2018.1455846>
- Ogut, M.O., Owuoch, J., & Muasya R. & Ouma, G. (2012). Effects of inter-specific interaction of nitrogen fertilizer and bean-maize cropping systems on quality of bean seed in Western Kenya. *Agriculture and Biology Journal of North America*, 3(4), 154–168. <https://doi.org/10.5251/abjna.2012.3.4.154.168>
- Oliveira, A.C.S. de, Coelho, F.C., Vieira, H.D., Crevelari, J.A., Souza, Á.I.A.F.e, Ferraz, T.M., & Rodrigues, A.A.C. (2017). Physiological quality and seed production of corn and fabaceae in monoculture and intercropping. *American Journal of Plant Sciences*, 08(11), 2597–2607. <https://doi.org/10.4236/ajps.2017.811175>
- Öner, F., & Aykutlu, H.M. (2019). The effect of maize-soybean intercropping systems on a set of technological and physiological properties. *Applied Ecology and Environmental Research*, 17(2), 2149–2165. https://doi.org/10.15666/aeer/1702_21492165
- Osang, P.O., Richard, B.I., & Itheadindume, C.A. (2014). Influence of date of planting and time of introduction of maize on the agronomic performance of soybean-maize intercrop in Nigerian southern-Guinea savanna. *Journal of Biology, Agriculture and Healthcare*, 4(3), 136–143.
- Paeru, R.H., & Dewi, T.Q. (2017). *Panduan praktis budidaya jagung*. Penebar Swadaya. Jakarta
- Palaniappan, S. (1985). *Cropping system in the tropics*. Wiley Eastern Limited and Tamil Nadu Agriculture University.

- Palijama, W., Riry, J., & Wattimena, A. (2012). Komunitas gulma pada pertanaman pala (*Myristica fragrans*) belum menghasilkan dan menghasilkan di desa Hutumuri kota Ambon. *Agrologia*, 1(2). <https://doi.org/10.30598/a.v1i2.289>
- Paliwal, R.L. (2000). *Tropical maize: improvement and production (FAO Plant Production and Protection Series)*. Food and Agriculture Organization of the United Nations.
- Permanasari, I., Sulistyaningsih, E., Kurniasih, B., & Indradewa, D. (2021). Soybean varieties tolerance to intercropping with maize. *IOP Conference Series: Earth and Environmental Science*, 883(1). <https://doi.org/10.1088/1755-1315/883/1/012033>
- Permanasari, I., Sulistyaningsih, E., Kurniasih, B., & Indradewa, D. (2023). Morphophysiological and yield traits of soybean varieties tolerant of intercropping with maize. *Biodiversitas*, 24(7), 3872–3880. <https://doi.org/10.13057/biodiv/d240726>
- Pertiwi, H.I., Soverda, N., & Evita. (2012). Pengaruh naungan terhadap kerapatan stomata dan trikoma daun serta pertumbuhan dan hasil dua varietas tanaman kedelai (*Glycine max* (L) Merrill). *Bioplantae*. 1(3): 197–207.
- Porte, A., Lux, G., Lewandowska, S., Kozak, M., Feller, J., & Schmidtke, K. (2022). Does a soybean intercrop increase nodule number, N uptake and grain yield of the followed main crop soybean? *Agriculture (Switzerland)*, 12(4). <https://doi.org/10.3390/agriculture12040467>
- Portes, T. de A., & de Melo, H.C. (2014). Interceptação de luz, área foliar e produção de biomassa em função da densidade de plantas de milho analisados por modelos matemáticos. *Acta Scientiarum - Agronomy*, 36(4), 457–463. <https://doi.org/10.4025/actasciagron.v36i4.17892>
- Prvulović, D., Malenčić, Đ., & Miladinović, J. (2016). Antioxidant activity and phenolic content of soybean seeds extracts. *Agro-Knowledge Journal*, 17(2), 121–132. <https://doi.org/10.7251/AGREN1602121P>
- Purwaningsih, O., Indradewa, D., & Kabirun, S. (2013). Tanggapan tanaman kedelai terhadap inokulasi *Rhizobium*. *Agrotrop: Journal on Agriculture Science*, 2(1), 25–32.
- Purwanti, S., Rizky Immawati, D., & Prajitno, D. (2018). The study on the seed storability of black soybean (*Glycine max* L. Merrill) intercropped with sweet sorghum (*Sorghum bicolor* L. Moench). *Planta Tropika: Journal of Agro Science*, 6(2), 116–121. <https://doi.org/10.18196/pt.2018.088.116-121>
- Qin, X., Pan, H., Xiao, J., Tang, L., & Zheng, Y. (2022). Increased nodular P level induced by intercropping stimulated nodulation in soybean under phosphorus deficiency. *Scientific Reports*, 12(1), 1–11. <https://doi.org/10.1038/s41598-022-05668-z>
- Rahayu, M., Sudarto, Puspadi, K., Mardian, I. (2009). *Paket teknologi produksi benih kedelai*. Balai Pengkajian Teknologi Pertanian Nusa Tenggara Barat.
- Raji, J. A. (2007). *Intercropping soybean and maize in a derived savanna ecology*. 6(August), 1885–1887.
- Rashwan, E., & Zeneldin, A.A. (2017). Effect of two patterns of intercropping soybean with maize on yield and its components under different nitrogen fertilizer levels. *Egyptian Journal of Agronomy*, 39(3), 449–466.

<https://doi.org/10.21608/agro.2017.1627.1074>

- Raza, M. A., Cui, L., Qin, R., Yang, F., & Yang, W. (2020). Strip-width determines competitive strengths and grain yields of intercrop species in relay intercropping system. *Scientific Reports*, 10(1), 1–12. <https://doi.org/10.1038/s41598-020-78719-y>
- Raza, M.A., Feng, L. Y., Iqbal, N., Ahmed, M., Chen, Y.K., Khalid, M.H. Bin, Din, A.M.U., Khan, A., Ijaz, W., Hussain, A., Jamil, M.A., Naeem, M., Bhutto, S.H., Ansar, M., Yang, F., & Yang, W. (2019). Growth and development of soybean under changing light environments in relay intercropping system. *PeerJ*, 2019(7). <https://doi.org/10.7717/peerj.7262>
- Raza, M.A., Feng, L.Y., Iqbal, N., Manaf, A., Khalid, M.H. Bin, Ur Rehman, S., Wasaya, A., Ansar, M., Billah, M., Yang, F., & Yang, W. (2018). Effect of sulphur application on photosynthesis and biomass accumulation of sesame varieties under rainfed conditions. *Agronomy*, 8(8). <https://doi.org/10.3390/agronomy8080149>
- Raza, M.A., Feng, L.Y., van der Werf, W., Cai, G.R., Khalid, M.H. Bin, Iqbal, N., Hassan, M.J., Meraj, T.A., Naeem, M., Khan, I., Rehman, S. ur, Ansar, M., Ahmed, M., Yang, F., & Yang, W. (2019). Narrow-wide-row planting pattern increases the radiation use efficiency and seed yield of intercrop species in relay-intercropping system. *Food and Energy Security*, 8(3). <https://doi.org/10.1002/fes3.170>
- Raza, M.A., Feng, L.Y., van der Werf, W., Iqbal, N., Khan, I., Khan, A., Din, A.M.U., Naeem, M., Meraj, T.A., Hassan, M.J., Khan, A., Lu, F.Z., Liu, X., Ahmed, M., Yang, F., & Yang, W. (2020). Optimum strip width increases dry matter, nutrient accumulation, and seed yield of intercrops under the relay intercropping system. *Food and Energy Security*, 9(2), 1–14. <https://doi.org/10.1002/fes3.199>
- Raza, M.A., Hayder, M., Khalid, B., Xia, Z., Feng, L.Y., Khan, I., Hassan, M.J., Ahmed, M., Ansar, M., Chen, Y.K., Fan, Y.F., Yang, F., & Yang, W. (2019). Effect of planting patterns on yield , nutrient accumulation and distribution in maize and soybean under relay intercropping systems. *Scientific Reports*, January, 1–14. <https://doi.org/10.1038/s41598-019-41364-1>
- Ren, Y. Y., Wang, X. L., Zhang, S. Q., Palta, J. A., & Chen, Y. L. (2017b). Influence of spatial arrangement in maize-soybean intercropping on root growth and water use efficiency. *Plant and Soil*, 415(1–2), 131–144. <https://doi.org/10.1007/s11104-016-3143-3>
- Ren, Y., Liu, J., Wang, Z., & Zhang, S. (2016a). Planting density and sowing proportions of maize-soybean intercrops affected competitive interactions and water-use efficiencies on the Loess Plateau, China. *European Journal of Agronomy*, 72, 70–79. <https://doi.org/10.1016/j.eja.2015.10.001>
- Ren, Y., Liu, J., Wang, Z., & Zhang, S. (2016b). Planting density and sowing proportions of maize-soybean intercrops affected competitive interactions and water-use efficiencies on the Loess Plateau, China. *European Journal of Agronomy*, 72, 70–79. <https://doi.org/10.1016/j.eja.2015.10.001>
- Ren, Y.Y., Wang, X.L., Zhang, S.Q., Palta, J.A., & Chen, Y.L. (2017a). Influence of spatial arrangement in maize-soybean intercropping on root growth and water use efficiency. *Plant and Soil*, 415(1–2), 131–144. <https://doi.org/10.1007/s11104-016-3143-3>

- Richard, W., Patricia, N., & Justus, M.S. (2015). Seed quality of three soybean varieties as influenced by intercropping time and arrangement in maize. *African Journal of Agricultural Research*, 10(6), 505–514. <https://doi.org/10.5897/ajar2014.8999>
- Roriz, M., Carvalho, S.M.P., & Vasconcelos, M.W. (2014). High relative air humidity influences mineral accumulation and growth in iron deficient soybean plants. *Frontiers in Plant Science*, 5(DEC), 1–8. <https://doi.org/10.3389/fpls.2014.00726>
- Rosielle, A.A., Hamlin, J. (1981). Theoretical aspects of selection for yield in stress and non-stress environment. *Crop Science*, 21(6), 943–946. <https://doi.org/https://doi.org/10.2135/cropsci1981.0011183X002100060033x>
- Rukmana, R., & Yuniarsih, Y. (1996). *Kedelai: budidaya dan pasca panen*. Kanisius, Yogyakarta. isbn: 9794973157
- Sakai, T., Kagawa, T., Kasahara, M., Swartz, T.E., Christie, J.M., Briggs, W.R., Wada, M., & Okada, K. (2001). Arabidopsis nph1 and npl1: Blue light receptors that mediate both phototropism and chloroplast relocation. *Proceedings of the National Academy of Sciences of the United States of America*, 98(12), 6969–6974. <https://doi.org/10.1073/pnas.101137598>
- Sale, P.W.G., & Campbell, L.C. (1986). Yield and composition of soybean seed as a function of potassium supply. *Plant and Soil*, 96(3), 317–325. <https://doi.org/10.1007/BF02375136>
- Salisbury, F.B. & Ross, C.W. (1995). *Plant physiology*. Penerjemah Diah R. Lukman, S. Penerbit ITB.
- Salvagiotti, F., Cassman, K.G., Specht, J.E., Walters, D.T., Weiss, A., & Dobermann, A. (2008). Nitrogen uptake, fixation and response to fertilizer N in soybeans: A review. *Field Crops Research*, 108(1), 1–13. <https://doi.org/10.1016/j.fcr.2008.03.001>
- Sari, A.R.K., Dharmawan, R., Yasa, I.M.R., Kamandalu, A.A.N.B., Aryawati, S.A.N., Hidayah, I.N., & Sutresna, I.N. (2022). Growth responses of maize-soybean intercropping system and its potential for cattle feed in Bali. *IOP Conference Series: Earth and Environmental Science*, 951(1). <https://doi.org/10.1088/1755-1315/951/1/012008>
- Setiawan, R.B., Indarwati, Fajarfika, R.; Asril, M., Jumawati, R., Puwaningsih, Joeniarti, E., Ramdan, E.P., & Arsi. (2021). *Teknologi Produksi Benih*. Yayasan Kita Menulis.
- Shafiq, I., Hussain, S., Raza, M.A., Iqbal, N., Asghar, M.A., Raza, A., Fan, Y. fang, Mumtaz, M., Shoaib, M., Ansar, M., Manaf, A., Yang, W. yu, & Yang, F. (2021). Crop photosynthetic response to light quality and light intensity. *Journal of Integrative Agriculture*, 20(1), 4–23. [https://doi.org/10.1016/S2095-3119\(20\)63227-0](https://doi.org/10.1016/S2095-3119(20)63227-0)
- Shibles, R. (1998). Relation of leaf nitrogen content and other traits with seed yield of soybean. *Plant Production Science*, 1(1), 3–7. <https://doi.org/10.1626/pps.1.3>
- Shibles, R.M., & Weber, C.R. (1965). Leaf area, solar radiation interception and dry matter production by soybeans. *Crop Science*, 5(6), 575–577. <https://doi.org/10.2135/cropsci1965.0011183x000500060027x>

- Silva, J.A. da, Dos Santos, P.A.B., de Carvalho, L.G., Moura, E.G., & Andrade, F.R. (2020). Gas exchanges and growth of soybean cultivars submitted to water deficiency. *Pesquisa Agropecuaria Tropical*, 50, 1–9. <https://doi.org/10.1590/1983-40632020V5058854>
- Sio-Se Mardeh, A., Ahmadi, A., Poustini, K., & Mohammadi, V. (2006). Evaluation of drought resistance indices under various environmental conditions. *Field Crops Research*, 98(2–3), 222–229. <https://doi.org/10.1016/j.fcr.2006.02.001>
- Siswadi. (2006). *Budidaya Tanaman Palawija*. PT.Citra Aji Parama, Yogyakarta.
- Sitompul, S.M., Sari, D.I., Krisnawati, E., Mulia, R.H., & Taufiq, M. (2015). Pod number and photosynthesis as physiological selection criteria in soybean (*Glycine max* L. Merrill) breeding for high yield. *Agrivita*, 37(1), 75–88. <https://doi.org/10.17503/Agrivita-2015-37-1-p075-088>
- Sterck, F., Anten, N.P.R., Schieving, F., Rietkerk, M., van Loon, M.P., & Dekker, S.C. (2014). How light competition between plants affects their response to climate change. *New Phytologist*, 203(4), 1253–1265. <https://doi.org/10.1111/nph.12865>
- Su, B.Y., Song, Y.X., Song, C., Cui, L., Yong, T.W., & Yang, W.Y. (2014). *Growth and photosynthetic responses of soybean seedlings to maize shading in relay intercropping system in Southwest China*. 52(3), 332–340. <https://doi.org/10.1007/s11099-014-0036-7>
- Suárez, J.C., Anzola, J.A., Contreras, A.T., Salas, D.L., Vanegas, J.I., Urban, M.O., Beebe, S.E., & Rao, I.M. (2022). Influence of simultaneous intercropping of maize-bean with input of inorganic or organic fertilizer on growth, development, and dry matter partitioning to yield components of two lines of common bean. *Agronomy*, 12(5). <https://doi.org/10.3390/agronomy12051216>
- Subekti, N.A., Syafruddin, Efendi, R., & Sunarti, S. (2008). Morfologi tanaman dan fase pertumbuhan jagung. *Balai Penelitian Tanaman Serealia, Maros*, 16–28.
- Sumarno, S., & Manshuri, A.G. (2007). Persyaratan tumbuh dan wilayah produksi kedelai di Indonesia. *Kedelai: Teknik Produksi Dan Pengembangan*, 74–103. http://balitkabi.litbang.pertanian.go.id/wp-content/uploads/2016/03/dele_4.sumarno-1.pdf
- Sumarno. (1990). Pembentukan varietas unggul Wilis. *Bul. Agr.*, XV(3). Balai Penelitian Tanaman Pangan. Bogor.
- Sunantora, I.M.M. (2000). Teknik produksi benih kedelai. *Instalasi Penelitian Dan Pengkajian Teknologi Pertanian Denpasar, September*, 1–4.
- Sundari, T. (2016). Penampilan galur-galur kedelai toleran naungan di dua lingkungan. *Buletin Palawija*, 14(2), 63–70.
- Sundari, T., & Mutmaidah, D.S. (2018a). Kesesuaian galur-galur harapan kedelai untuk tumpangsari jagung + kedelai. *Jurnal Agronomi Indonesia (Indonesian Journal of Agronomy)*, 46(1), 40. <https://doi.org/10.24831/jai.v46i1.14880>
- Sundari, T., & Mutmaidah, D.S. (2018b). Identification of soybeans genotypes suitable for intercropping with cassava. *Jurnal Ilmu Pertanian Indonesia*, 23(1), 29–37. <https://doi.org/10.18343/jipi.23.1.29>
- Sundari, T., & Wahyuningsih, S. (2017). Penampilan karakter kuantitatif genotipe kedelai di bawah naungan. *Indonesian Journal of Biology*, 13(1), 137–147.

- Sundari, T., Mutmaidah, S., & Baliadi, Y. (2019). Keunggulan kompetitif agronomis dan ekonomis lima belas genotipe kedelai pada tumpangsari dengan jagung. *Buletin Palawija*, 17(1), 46–56. <https://doi.org/10.21082/bulpa.v17n1.2019.p46-56>
- Sundari, T., Susanto, A., & Wahyu, G. (2015). Pertumbuhan dan hasil biji genotipe kedelai di berbagai intensitas naungan. *Jurnal Penelitian Pertanian Tanaman Pangan*, 34(3), 203–218. <https://doi.org/10.21082/jpntp.v34n3.2015.p203-217>.
- Susanto, G.W.A., & Nugrahaeni, N. (2016). Pengenalan dan karakteristik varietas unggul kedelai). *Prosiding seminar hasil penelitian tanaman aneka kacang dan umbi 2011*, 61, 17–28.
- Sutopo, L. (2002). *Teknologi Benih*. Raja Grafindo Persada, Jakarta.
- Taah, K.J., Buah, J.N., & Ogyiriadu, E. (2017). Evaluation of spatial arrangement of legumes on weed suppression in cassava production. *ARPN Journal of Agricultural and Biological Science*. 12(1), 1–11.
- Tagliapietra, E.L., Streck, N.A., Da Rocha, T.S.M., Richter, G.L., Da Silva, M.R., Cera, J.C., Guedes, J.V.C., & Junior Zanon, A. (2018). Optimum leaf area index to reach soybean yield potential in subtropical environment. *Agronomy Journal*, 110(3), 932–938. <https://doi.org/10.2134/agronj2017.09.0523>
- Taiz, L., & Zeiger, E. (2002). *Plant Physiology*. Sinauer Associates; 3 edition.
- Taufiq, A., & Sundari, T. (2012). Lingkungan Tumbuh Kedelai. *Buletin Palawija*, 26(23), 13–26.
- Telkar, S.G., Singh, A.K., & Dey, J.K. (2017). Effect of population proportion of component crops on growth, yield and nutrient uptake of component crops in maize+soybean intercropping. *International Journal of Bio-Resource and Stress Management*, 8(6), 779–783. <https://doi.org/10.23910/ijbsm/2017.8.6.3c0363>
- Terashima, I., Miyazawa, S.I., & Hanba, Y.T. (2001). Why are sun leaves thicker than shade leaves? - Consideration based on analyses of CO₂ diffusion in the leaf. *Journal of Plant Research*, 114(1), 93–105. <https://doi.org/10.1007/pl00013972>
- Testa, G., Reyneri, A., & Blandino, M. (2016). Maize grain yield enhancement through high plant density cultivation with different inter-row and intra-row spacings. *European Journal of Agronomy*, 72, 28–37. <https://doi.org/10.1016/j.eja.2015.09.006>
- Thanacharoenchanaphas, K. & Rugchati, O. (2015). Impacts of atmospheric temperature - humidity changes on yield quality of thai soybean cultivar. *International Journal of Environmental and Rural Development*. 6(2): 115–120.
- Thilakarathna, M.S., McElroy, M.S., Chapagain, T., Papadopoulos, Y.A., & Raizada, M.N. (2016). Belowground nitrogen transfer from legumes to non-legumes under managed herbaceous cropping systems. A review. *Agronomy for Sustainable Development*, 36(4). <https://doi.org/10.1007/s13593-016-0396-4>
- Tohari. (2018). *Geometri dan sistem pertanaman dalam aspek dasar agronomi berkelanjutan*. Gadjah Mada University Press. Yogyakarta.

- Tsujimoto, Y., Pedro, J.A., Boina, G., Murracama, M.V., Ito, O., Tobita, S., Oya, T., Cuambe, C.E., & Martinho, C. (2015b). Performance of maize-soybean intercropping under various N application rates and soil moisture conditions in northern Mozambique. *Plant Production Science*, 18(3), 365–376. <https://doi.org/10.1626/pps.18.365>
- Tsujimoto, Y., Pedro, J.A., Boina, G., Murracama, M.V., Ito, O., Tobita, S., Oya, T., Cuambe, C.E., & Martinho, C. (2015a). Performance of maize-soybean intercropping under various N application rates and soil moisture conditions in Northern Mozambique. *Plant Production Science*, 18(3), 365–376. <https://doi.org/10.1626/pps.18.365>
- Tsukaya, H. (2006). Mechanism of leaf-shape determination. *Annual Review of Plant Biology*, 57, 477–496. <https://doi.org/10.1146/annurev.arplant.57.032905.105320>
- Turmudi, E. (2002). Kajian pertumbuhan dan hasil tanaman dalam sistem tumpangsari jagung dengan empat kultivar kedelai pada berbagai waktu tanam. *Jurnal Ilmu-Ilmu Pertanian Indonesia*, 4(2), 89–96. <http://repository.unib.ac.id/258/1/89.PDF>
- Umarie, I., & Holil, M. (2017). Potensi hasil dan kontribusi sifat agronomi terhadap hasil tanaman kedelai (*Glycine max* L. Merril) pada sistem tumpangsari tebu-kedelai. *Agritrop : Jurnal Ilmu-Ilmu Pertanian (Journal of Agricultural Science)*, 14(1), 1–11. <https://doi.org/10.32528/agr.v14i1.402>
- Umarie, I., Hazmi, M., & Oktarina, O. (2019). Penampilan sepuluh varietas kedelai yang ditumpangsarikan dengan tebu. *Jurnal Ilmu-Ilmu Pertanian Indonesia*, 20(2), 60–65. <https://doi.org/10.31186/jipi.20.2.60-65>
- Valladares, F., & Niinemets, Ü. (2008). Shade tolerance, a key plant feature of complex nature and consequences. *Annual Review of Ecology, Evolution, and Systematics*, 39, 237–257. <https://doi.org/10.1146/annurev.ecolsys.39.110707.173506>
- van den Hurk, B.J.J.M., Viterbo, P., & Los, S.O. (2003). Impact of leaf area index seasonality on the annual land surface evaporation in a global circulation model. *Journal of Geophysical Research: Atmospheres*, 108(6). <https://doi.org/10.1029/2002jd002846>
- Verdelli, D., Acciaresi, H.A., & Leguizamón, E. S. (2012). Corn and soybeans in a strip intercropping system: crop growth rates, radiation interception, and grain yield components. *International Journal of Agronomy*, 2012, 1–17. <https://doi.org/10.1155/2012/980284>
- Wan, Y., Yan, Y., Xiang, D., Ye, M., Yang, W., & Liu, J. (2015). Isoflavonoid accumulation pattern as affected by shading from maize in soybean (*Glycine max* (L.) Merr.) in relay strip intercropping system. *Plant Production Science*, 18(3), 302–313. <https://doi.org/10.1626/pps.18.302>
- Wang, R., Sun, Z., Zhang, L., Yang, N., Feng, L., Bai, W., Zhang, D., Wang, Q., Evers, J.B., Liu, Y., Ren, J., Zhang, Y., & van der Werf, W. (2020). Border-row proportion determines strength of interspecific interactions and crop yields in maize/peanut strip intercropping. *Field Crops Research*, 253(April), 107819. <https://doi.org/10.1016/j.fcr.2020.107819>
- Wang, X., Gao, Y., Zhang, H., Shao, Z., Sun, B., & Gao, Q. (2020). Enhancement of rhizosphere citric acid and decrease of NO₃⁻/NH₄⁺ ratio by root

- interactions facilitate N fixation and transfer. *Plant and Soil*, 447(1–2), 169–182. <https://doi.org/10.1007/s11104-018-03918-6>
- Wang, X., Wu, X., Ding, G., Yang, F., Yong, T., Wang, X., & Yang, W. (2020). Analysis of grain yield differences among soybean cultivars under maize–soybean intercropping. *Agronomy*, 10(1), 1–17. <https://doi.org/10.3390/agronomy10010109>
- Wei, W., Liu, T., Shen, L., Wang, X., Zhang, S., & Zhang, W. (2022). Effect of maize (*Zea mays*) and soybean (*Glycine max*) intercropping on yield and root development in Xinjiang, China. *Agriculture (Switzerland)*, 12(7). <https://doi.org/10.3390/agriculture12070996>
- Wei, Y., Jin, J., Jiang, S., Ning, S., & Liu, L. (2018). Quantitative response of soybean development and yield to drought stress during different growth stages in the Huaibei plain, China. *Agronomy*, 8(7). <https://doi.org/10.3390/agronomy8070097>
- Weil, R.R., & Brady, N.C. (2016). *The nature and properties of soil. 15th edition. April*, 933. ISBN 9780133254488
- Wen, B. xiao, Hussain, S., Yang, J. yue, Wang, S., Zhang, Y., Qin, S. si, Xu, M., Yang, W. yu, & Liu, W. guo. (2020). Rejuvenating soybean (*Glycine max* L.) growth and development through slight shading stress. *Journal of Integrative Agriculture*, 19(10), 2439–2450. [https://doi.org/10.1016/S2095-3119\(20\)63159-8](https://doi.org/10.1016/S2095-3119(20)63159-8)
- Widiarti, W., Umarie, I., & Muktar, A. (2011). Respon berbagai varietas kedelai, perimbangan pemupukan dan hasil tanaman kedelai (*Glycine Max* (L) Merrill) pada budidaya tumpang sari tebu system (100 x 15cm). *Agrotrop*. 37–44.
- Wijanarko, A., Noerwijati, K.A.I., & Krishnawati, A & Kristiono, A.M. (2014). *Hasil utama penelitian tanaman aneka kacang dan umbi*. Balai Penelitian Tanaman Aneka Kacang dan Umbi.
- Wijaya, A.A., Rahayu, H.D., Oksifa, A.R.H., Rachmadi, M., & Karuniawan, A. (2015). Penampilan karakter agronomi 16 genotip kedelai (*Glycine max* L. Merrill) pada pertanaman tumpangsari dengan jagung (*Zea mays* L.) pola 3:1. *Jurnal Agro*, 2(2), 30. <https://doi.org/10.15575/436>
- Willey, R.W., & Rao, M.R. (1980). A competitive ratio for quantifying competition between intercrops. *Expl. Agric.*, 16(104), 117–125. <https://doi.org/http://dx.doi.org/10.1017/S0014479700010802>
- Wood, C.W., Reeves, D.W., Duffield, R.R., & Edmisten, K.L. (1992). Field chlorophyll measurements for evaluation of corn nitrogen status. *Journal of Plant Nutrition*, 15(4), 487–500. <https://doi.org/10.1080/01904169209364335>
- Worku, W. (2014). Sequential intercropping of common bean and mung bean with maize in southern Ethiopia. *Experimental Agriculture*, 50(1), 90–108. <https://doi.org/10.1017/S0014479713000434>
- Wu, Y. shan, Yang, F., Gong, W. zhao, Ahmed, S., Fan, Y. fang, Wu, X. ling, Yong, T. wen, Liu W. guo, Shu, K., Liu, J., Du, J. bo, & Yang, W. yu. (2017). Shade adaptive response and yield analysis of different soybean genotypes in relay intercropping systems. *Journal of Integrative Agriculture*, 16(6), 1331–1340. [https://doi.org/10.1016/S2095-3119\(16\)61525-3](https://doi.org/10.1016/S2095-3119(16)61525-3)
- Wu, Y., Gong, W., & Yang, W. (2017). Shade Inhibits Leaf Size by Controlling Cell

Proliferation and Enlargement in Soybean. *Scientific Reports*, 7(1), 1–10.
<https://doi.org/10.1038/s41598-017-10026-5>

- Wu, Y., Gong, W., Wang, Y., Yong, T., Yang, F., Liu, W., Wu, X., Du, J., Shu, K., Liu, J., Liu, C., & Yang, W. (2018). Leaf area and photosynthesis of newly emerged trifoliate leaves are regulated by mature leaves in soybean. *Journal of Plant Research*, 131(4), 671–680. <https://doi.org/10.1007/s10265-018-1027-8>
- Wu, Y., Gong, W., Yang, F., Wang, X., Yong, T., Liu, J., Pu, T., Yan, Y., & Yang, W. (2022). Dynamic of recovery growth of intercropped soybean after maize harvest in maize–soybean relay strip intercropping system. *Food and Energy Security*, 11(1), 1–14. <https://doi.org/10.1002/fes3.350>
- Wu, Y., He, D., Wang, E., Liu, X., Huth, N. I., Zhao, Z., Gong, W., Yang, F., Wang, X., Yong, T., Liu, J., Liu, W., Du, J., Pu, T., Liu, C., Yu, L., van der Werf, W., & Yang, W. (2021). Modelling soybean and maize growth and grain yield in strip intercropping systems with different row configurations. *Field Crops Research*, 265(February). <https://doi.org/10.1016/j.fcr.2021.108122>
- Xu, B.J., & Chang, S.K.C. (2007). A comparative study on phenolic profiles and antioxidant activities of legumes as affected by extraction solvents. *Journal of Food Science*, 72(2). <https://doi.org/10.1111/j.1750-3841.2006.00260.x>
- Yang, C., Fan, Z., & Chai, Q. (2018). Agronomic and economic benefits of pea/maize intercropping systems in relation to N fertilizer and maize density. *Agronomy*, 8(4). <https://doi.org/10.3390/agronomy8040052>
- Yang, C., Hu, B., Iqbal, N., Yang, F., Liu, W. guo, Wang, X. chun, Yong, T. wen, Zhang, J., Yang, W. yu, & Liu, J. (2018). Effect of shading on accumulation of soybean isoflavonoid under maize-soybean strip intercropping systems. *Plant Production Science*, 21(3), 193–202. <https://doi.org/10.1080/1343943X.2018.1484257>
- Yang, F., Huang, S., Gao, R., Liu, W., Yong, T., Wang, X., Wu, X., & Yang, W. (2014). Growth of soybean seedlings in relay strip intercropping systems in relation to light quantity and red: far-red ratio. *Field Crops Research*, 155, 245–253. <https://doi.org/10.1016/j.fcr.2013.08.011>
- Yang, F., Liao, D., Fan, Y., Gao, R., Wu, X., Rahman, T., Yong, T., Liu, W., Liu, J., Du, J., Shu, K., Wang, X., & Yang, W. (2017). Effect of narrow-row planting patterns on crop competitive and economic advantage in maize-soybean relay strip intercropping system. *Plant Production Science*, 20(1), 1–11. <https://doi.org/10.1080/1343943X.2016.1224553>
- Yang, F., Liao, D., Wu, X., Gao, R., Fan, Y., Raza, M. A., Wang, X., Yong, T., Liu, W., Liu, J., Du, J., Shu, K., & Yang, W. (2017). Effect of aboveground and belowground interactions on the intercrop yields in maize-soybean relay intercropping systems. *Field Crops Research*, 203, 16–23. <https://doi.org/10.1016/j.fcr.2016.12.007>
- Yang, W., Miao, J., Wang, X., Xu, J., Lu, M., & Li, Z. (2018). Corn-soybean intercropping and nitrogen rates affected crop nitrogen and carbon uptake and C:N ratio in upland red soil. *Journal of Plant Nutrition*, 41(15), 1890–1902. <https://doi.org/10.1080/01904167.2018.1476540>
- Yao, X., Zhou, H., Zhu, Q., Li, C., Zhang, H., Wu, J. J., & Xie, F. (2017). Photosynthetic response of Soybean leaf to wide light-fluctuation in Maize-

- soybean intercropping system. *Frontiers in Plant Science*, 8(September), 1–10. <https://doi.org/10.3389/fpls.2017.01695>
- Yilmaz, Ş., Atak, M., & Erayman, M. (2008). Identification of advantages of maize-legume intercropping over solitary cropping through competition indices in the east mediterranean region. *Turkish Journal of Agriculture and Forestry*, 32(2), 111–119. <https://doi.org/10.3906/tar-0708-33>
- Yogesh, S., Halikatti, S.I., Hiremath, S.M., Potdar, M.P., Harlapur, S.I., & Venkatesh, H. (2014). Light use efficiency, productivity and profitability of maize and soybean intercropping as influenced by planting geometry and row proportion. *Karnataka Journal of Agricultural Sciences*, 27(1), 1–4.
- Yong, T. wen, Chen, P., Dong, Q., Du, Q., Yang, F., Wang, X. chun, Liu, W. guo, & Yang, W. yu. (2018). Optimized nitrogen application methods to improve nitrogen use efficiency and nodule nitrogen fixation in a maize-soybean relay intercropping system. *Journal of Integrative Agriculture*, 17(3), 664–676. [https://doi.org/10.1016/S2095-3119\(17\)61836-7](https://doi.org/10.1016/S2095-3119(17)61836-7)
- Yu-shan, W. U., Feng, Y., Wan-zhuo, G., Ahmed, S., Yuan-fang, F. A. N., & Xiaoling, W. U. (2017). Shade adaptive response and yield analysis of different soybean genotypes in relay intercropping systems. *Journal of Integrative Agriculture*, 16(6), 1331–1340. [https://doi.org/10.1016/S2095-3119\(16\)61525-3](https://doi.org/10.1016/S2095-3119(16)61525-3)
- Zaeem, M., Nadeem, M., Pham, T.H., Ashiq, W., Ali, W., Gilani, S.S.M., Elavarthi, S., Kavanagh, V., Cheema, M., Galagedara, L., & Thomas, R. (2019). The potential of corn-soybean intercropping to improve the soil health status and biomass production in cool climate boreal ecosystems. *Scientific Reports*, 9(1), 1–17. <https://doi.org/10.1038/s41598-019-49558-3>
- Zhang, G., Yang, Z., & Dong, S. (2011). Interspecific competitiveness affects the total biomass yield in an alfalfa and corn intercropping system. *Field Crops Research*, 124(1), 66–73. <https://doi.org/10.1016/j.fcr.2011.06.006>
- Zhang, H., Zeng, F., Zou, Z., Zhang, Z., & Li, Y. (2017). Nitrogen uptake and transfer in a soybean/maize intercropping system in the karst region of southwest China. *Ecology and Evolution*, 7(20), 8419–8426. <https://doi.org/10.1002/ece3.3295>
- Zhang, J., Smith, D.L., Liu, W., Chen, X., & Yang, W. (2011). *Effects of shade and drought stress on soybean hormones and yield of main-stem and branch*. 10(65), 14392–14398. <https://doi.org/10.5897/AJB11.2143>
- Zhang, L., Kusaba, M., Tanaka, A., & Sakamoto, W. (2016). Protection of chloroplast membranes by VIPP1 rescues aberrant seedling development in *Arabidopsis nyc1* mutant. *Frontiers in Plant Science*, 7(APR2016), 1–11. <https://doi.org/10.3389/fpls.2016.00533>
- Zhang, Y., Sun, Z., Su, Z., Du, G., Bai, W., Wang, Q., Wang, R., Nie, J., Sun, T., Feng, C., Zhang, Z., Yang, N., Zhang, X., Evers, J. B., van der Werf, W., & Zhang, L. (2022). Root plasticity and interspecific complementarity improve yields and water use efficiency of maize/soybean intercropping in a water-limited condition. *Field Crops Research*, 282(March), 108523. <https://doi.org/10.1016/j.fcr.2022.108523>
- Zheng, B., Zhang, X., Chen, P., Du, Q., Zhou, Y., Yang, H., Wang, X., Yang, F., Yong, T., & Yang, W. (2021). Improving maize's N uptake and N use efficiency

by strengthening roots' absorption capacity when intercropped with legumes. *PeerJ*, 1–17. <https://doi.org/10.7717/peerj.11658>

Zheng, Y., Guo, Y., Li, Y., Yang, W., & Dong, Y. (2022). Intercropping of wheat alleviates the adverse effects of phenolic acids on faba bean. *Frontiers in Plant Science*, 13(October), 1–18. <https://doi.org/10.3389/fpls.2022.997768>

Zheng, Y., Guo, Y., Lv, J., Dong, K., & Dong, Y. (2022). Faba bean-wheat intercropping can control the occurrence of faba bean fusarium wilt by alleviating the inhibitory effect of benzoic acid on disease resistance metabolism and the expression of resistance genes. *ACS Omega*. <https://doi.org/10.1021/acsomega.2c04569>

Zou, J.L., Liu, W.G., Yuan, J., Jiang, T., Ye, S.Q., Deng, Y.C., Yang, C.Y., Luo, L., & Yang, W.Y. (2015). Relationship between lignin synthesis and lodging resistance at seedlings stage in soybean intercropping system. *Acta Agronomica Sinica(China)*, 41(7), 1098–1104. <https://doi.org/10.3724/SP.J.1006.2015.01098>