

ANALIZA TROŠKOVA RADNE SNAGE U PROIZVODNJI MALINE NA ODABRANIM GAZDINSTVIMA U SRBIJI U 2024. GODINI

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Rezime

Autori u radu analiziraju značaj i strukturu troškova radne snage u proizvodnji maline na odabranim gazdinstvima u Srbiji tokom sezone 2024. godine. Uzorak čine 174 gazdinstva koja su obrađivala 101,12 hektara maline sorte Vilamet sa postignutim prinosom od 1.061.907 kilograma, čime se ostvario prihod od 2,27 miliona evra. Prosečna veličina gazdinstva bila je 0,58 hektara, sa prinosima od 10.501 kg/ha i prihodima od 22.403 evra/ha. Utrošen rad iznosio je ukupno 320,4 radna dana po hektaru, sa pratećim troškovima od 13.238,5 evra/ha ili 1,263 evra/kg. Berba je bila radno najintenzivnija operacija, čineći 66,6% ukupnog utrošenog rada, dok su rad na održavanju voćnjaka i pomoćni poslovi činili 33,4%. Troškovi spoljno angažovane radne snage u proseku su iznosili 0,703 evra/kg, a troškovi porodičnog rada 0,56 evra/kg. Indikatori produktivnosti pokazali su da je svakog radnog dana proizvedeno 32,78 kg malina i ostvaren prihod od 69,92 evra, pri čemu svaki evro uložen u rad generiše prihod od 1,69 evra. Rezultati istraživanja naglašavaju veliki značaj efikasnosti rada u održavanju profitabilnosti u sistemima proizvodnje voća koji zahtevaju mnogo rada kao što je proizvodnja maline.

Ključne reči: proizvodnja maline, troškovi radne snage, profitabilnost malih farmi, Vilamet.

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Uvod

Malina predstavlja jednu od najznačajnijih voćarskih kultura u Srbiji i ima veliki ekonomski značaj za domaću poljoprivredu i izvoz. Srbija je jedan od najvećih proizvođača maline u svetu, pored Poljske, Čilea i Meksika. Proizvodnja maline je značajna kako u pogledu prihoda od izvoza, tako i u pogledu zapošljavanja na selu (Milosavljević et al., 2025). Proizvodnja maline u Srbiji uglavnom je skoncentrisana u području zapadne i centralne Srbije, pri čemu se posebno izdvajaju regioni Arilja, Požega, Kosjerić, Bajina Bašta, Užice u zlatiborskom okrugu, kao i Ivanjice, Čačak i Lučani u moravičkom okrugu. Najzastupljenija sorta je Vilamet, koja je cenjena zbog kvaliteta, a značajnu ulogu imaju i sorte Miker i Polka. Ukupna proizvodnja varira u zavisnosti od klimatskih uslova, prinosa i drugih faktora i u poslednjim decenijama se kretala između 80.000 i 100.000 tona godišnje, a površine pod malinom u Srbiji se kreću između 15.000 i 20.000 hektara. U Srbiji maline čine značajan udeo u poljoprivrednom izvozu, obezbeđujući vitalne prihode hiljadama malih poljoprivrednih domaćinstava. Najveći deo proizvedene maline se izvozi u zamrznutom stanju na tržišta zemlje Evropske unije, pre svega Nemačka, Francuska i Austrija. Međutim, ovaj sektor se suočava sa stalnim izazovima, posebno onima koji su povezani sa nestabilnim cenama, rastućim troškovima ulaganja i velikom zavisnošću od sezone i porodične radne snage (Milosavljević et al., 2025). Proizvodnja maline zahteva značajno angažovanje radne snage, zbog čega se ubraja među najintenzivnije grane voćarske proizvodnje. Poslednjih godina se sve više javlja problem nedostatka radne snage u Srbiji u sektoru proizvodnje jagodičastih voćnih vrsta, prvenstveno zbog teških uslova rada, sezonskog karaktera zaposlenja i migracije stanovništva iz ruralnih područja, što se odražava i na ekonomske rezultate i na kvalitet proizvoda i pravovremenost berbe. Pored sezonskih radnika, značajnu ulogu u proizvodnji malina ima i rad članova porodičnih poljoprivrednih gazdinstava. Pored navedenog, nestabilnost cena ostaje jedan od najvećih rizika za proizvođače maline u Srbiji. Na cene maline utiču međunarodna potražnja, klimatski šokovi, globalna konkurencija. Shodno tome, profitabilnost proizvodnje maline u Srbiji je veoma neizvesna i mali poljoprivrednici često nemaju alate za predviđanje tržišnih promena (Milosavljević et al., 2025).

Autori u radu analiziraju značaj radne snage i strukturu troškova radne snage u proizvodnji maline na odabranim gazdinstvima u Srbiji tokom sezone 2024. godine. Primarni cilj rada je da se postojeći standardi ulaganja rada u proizvodnju maline iz literature prilagode metodološkom okviru za procenu obima utrošenog porodičnog rada i troškova na odabranim poljoprivrednim gazdinstvima. Ovaj pristup ima za cilj da poboljša tačnost procena ukupnih troškova radne snage i, na kraju krajeva, ukupnih troškova proizvodnje maline. Sekundarni cilj je da se ovaj okvir primeni za izračunavanje i analizu troškova radne snage u proizvodnji maline na odabranim poljoprivrednim porodičnim gazdinstvima u Srbiji tokom proizvodne 2024. godine. Ovo istraživanje je deo šireg istraživanja o profitabilnosti proizvodnje maline u Republici Srbiji.

2 Materijal i metod rada

U ovom istraživanju korišćena je baza podataka Instituta za primenu nauke u poljoprivredi, koja je konstruisana od grupe poljoprivrednih gazdinstava čija je primarna ekonomska delatnost proizvodnja maline (u daljem tekstu „odabrana porodična gazdinstva“). Ova gazdinstva su identifikovana u skladu sa odredbama Pravilnika o načinu obavljanja savetodavnih poslova u poljoprivredi (Službeni glasnik Republike Srbije, br. 65/2014), koji čini sastavni deo Uredbe o utvrđivanju Godišnjeg programa razvoja savetodavnih poslova u poljoprivredi, koji se donosi posebno za svaku kalendarsku godinu.

Baza podataka o proizvodnji maline u Srbiji za 2024. godinu obuhvata 223 odabrana poljoprivredna gazdinstva koja uzgajaju osam različitih sorti maline: Vilamet (192), Polka (13), Polana (6), Enrosadira (4), Glen Ampl (3), Fertodi Zamatos (2), Miker (2) i Tulamin (1). Od 192 gazdinstva koja uzgajaju sortu Vilamet, 181 je realizovalo proizvodnju maline u okviru konvencionalnog sistema otvorenog polja. Nakon isključivanja sedam gazdinstava sa nepotpunim podacima, konačni uzorak u istraživanju je obuhvatio 174 poljoprivredna gazdinstva korišćena za analizu.

Baza podataka za liniju proizvodnje maline sadrži primarne podatke o utrošku spoljno angažovane radne snage i odgovarajućim dnevnim zaradama za sledeće radne operacije: obrada zemljišta, đubrenje, orezivanje i uklanjanje mladih izdanaka, orezivanje i uklanjanje starih izdanaka, berba i prskanje. Ovi prikupljeni podaci predstavljaju troškove za specifične radne operacije u proizvodnji maline tokom proizvodne 2024. godine.

Struktura upitnika koji se koristi za prikupljanje podataka je ista i ujednačena za sve linije proizvodnje voća u okviru softvera za prikupljanje podataka. Pored gore pomenutih radnih operacija, postoje i drugi zadaci, kako za održavanje voćnjaka, tako i za pomoćne aktivnosti. Uloženi rad za operacije kao što su vezivanje štapova i zatezanje žica, navodnjavanje i priprema zaštitnih rastvora su procenjene i uključene u ostale troškove porodičnog rada.

Važno je napomenuti da u praksi porodični rad takođe obuhvata aktivnostima kao što su nabavka proizvodnog materijala, prevoz radnika i ubranog voća, inspekcije na terenu i slični drugi zadaci. Uloženi rad za ove aktivnosti se retko procenjuju pojedinačno. Umesto toga, obično se usvaja konsolidovana procena. Procena uloženog porodičnog rada za ove aktivnosti je takođe uključena u ostale troškove porodičnog rada.

Procena uloženog porodičnog rada po pojedinačnim operacijama zasnovana je na utvrđenim podacima iz stručne literature. Ključna karakteristika odabranih gazdinstava je da su izabrani posebno zbog njihove široke primene preporučenih pomotehničkih praksi, što ih takođe kvalifikuje kao demonstraciona gazdinstva. Kao rezultat toga, ova gazdinstva postižu znatno veće prinose u poređenju sa nacionalnim prosekom u Srbiji – često ga premašuju za više od 100%.

Troškovi porodičnog rada predstavljaju ključnu komponentu ukupnih troškova poljoprivredne proizvodnje, ali se često zanemaruju. Uobičajeni pristupi njihovoj proceni uključuju metodu zamene tržišnih plata (Picazo-Tadeo et al., 2005) i metodu oportunitetnih troškova (Rosenzweig i Udry, 2014). Oba pristupa procenjuju vrednost porodičnog rada primenom preovlađujućih lokalnih stopa plata na sate koje doprinose članovi domaćinstva, efikasno ih tretirajući kao da su zaposleni radnici.

Procena ulaganja porodičnog rada nije uvek jednostavan zadatak. Glavni izazov leži u činjenici da poljoprivrednici obično ne vode sistematsku evidenciju o korišćenju porodične radne snage. Štaviše, čak i unutar iste sorte maline i sistema proizvodnje, potrebe za radnom snagom za pojedinačne operacije mogu značajno da variraju. Ove razlike mogu biti značajne ne samo između različitih gazdinstava u istoj proizvodnoj godini, već i unutar jednog gazdinstva tokom različitih godina.

Koristeći se naučnom literaturom i konsultacijama sa stručnjacima iz Poljoprivrednih savetodavnih službi Srbije, kao i sa samim proizvođačima, izvedene su procene ulaganja rada za određene operacije. Termin standardizovani utrošci rada usvojen je za opisivanje ovih procena specifičnih radnih operacija. Važno je napomenuti da se ovi standardizovani utrošci odnose isključivo na proizvodnu 2024. godinu i treba ih smatrati prosečnim aproksimacijama.

Za sve operacije gde je utrošak spoljašnjeg angažovanog rada bio jednak ili veći od standardizovanog utroška, porodični rada je procenjen kao nula. Nasuprot tome, za operacije gde je utrošak spolja angažovanog rada bio niži od standardizovane vrednosti, utrošak porodičnog rada je procenjen kao razlika između standardizovanog utroška i utroška spolja angažovanog ada.

2 Rezultati istraživanja sa diskusijom

Uzorak u istraživanju je obuhvatio 174 odabranih poljoprivrednih gazdinstava u Srbiji, koja su u 2024. godini proizvela ukupno 1.061.907,00 kilograma maline i ostvarila prihod od 2.265.366,77 evra. Tabela 1 prikazuje strukturu pomenutih rezultata proizvodnje maline u Srbiji u 2024. godini.

Tabela 1. Rezultati proizvodnje maline u 2024. godini

Vrednost / Indikator	Površina (ha)	Prinos (kg/ha)	Prihod (€/ha)
Minimum	0,15	3.000,00	5.122,08
Maksimum	2,50	27.000,00	57.623,36
Prosek	0,58	10.501,45	22.402,76
Suma	101,12	1.061.907,00*	2.265.366,77**

Izvor: modifikovano prema Čanak i Tomić, 2025. Legenda: *kg, ** €

Postignuti rezultati su dobijeni ulaganjem specifičnih proizvodnih faktora, među kojima se radna snaga pokazala kao najznačajnija. Prema Čanak i Tomić (2025) na osnovu analize varijabilnih troškova u okviru istog uzorka, pokazano je da troškovi radne snage čine 90% (1,26 €/kg) ukupnih varijabilnih troškova (1,40 €/kg).

Autori navode da je u proizvodnim linijama koje u velikoj meri zavise od ljudskog rada neophodno detaljnije ispitivanje ulaganja rada i troškova rada. Tabela 2 prikazuje utrošak rada po pojedinim radnim operacijama u proizvodnji maline prema različitim izvorima literature i istraživanjima.

Tabela 2. Utrošak rada po radnoj operaciji

Rasipanje stajnjaka (radni dan; sat*)	Rasipanje mineralnog đubriva (radni dan; sat*)	Vezivanje izdanaka i zatezanje žice (radni dan; sat*)	Orezivanje mladih izdanaka (3x) (radni dan; sat*)	Orezivanje i uklanjanje starih izdanaka (radni dan; sat*)	Ručno okopavanje u redovima (radni dan, sat*)	Navodnjavanje (radni dan)	Berba (kg/radni dan; kg/h*)	Priprema zaštitnog rastvora (radni dan)	Ostali poslovi (radni dan)	Ukupo – bez berbe (radni dan)	Reference
5	4	20	2	20	20	-	50	3	4	96	Milinković et.al, 2005
5	4	20	2	10	20	-	40	-	-	79	Veljković et al., 2006
-	-	800 - 1100*			300 – 400*	-	4*	-	-	1100 – 1500*	Apáti, F., 2014
6	3	30	2	15	20	-	48	-	-	94	Lukić et al., 2015.
5	5	5	1	10	20	5	56,4	-	-	105	Kljajić et al., 2017
-	-	-	-	-	-	-	50-60	-	-	-	Veljković et al., 2019

Izvor: Autori. Legenda: *u radnim satima

Iz Tabele 2 se može videti da se procenjuje da su potrebe za radnom snagom, isključujući berbu, između 79 radnih dana po hektaru (Veljković et al., 2006) i 150 radnih dana po hektaru, pod pretpostavkom radnog dana od 10 sati ili 187,5 radnih dana po hektaru pod pretpostavkom radnog dana od 8 sati (Apati, 2014). Produktivnost berbe kreće se između 40 kg/radni dan i 60 kg/radni dan, u zavisnosti

od veštine berača i nivoa prinosa. Ako se usvoji prosečna produktivnost berbe od 50 kg/radni dan, potrebe za radnom snagom pri prinosu od 10 t/ha iznose 200 radnih dana po hektaru. Terensko istraživanje proizvodnje maline u Srbiji sprovedeno anketiranjem u 2025. godini pokazalo je da se prosečna produktivnost žetve u poslednjoj deceniji kretala između 35 kg/radni dan i 65 kg/radni dan u većini situacija.

Utrošak porodičnog rada određen je oduzimanjem broja radnih dana spoljno angažovanog rada od ukupnog broja radnih dana za svaku pojedinačnu operaciju. Ukupna potreba za radom, izražena u radnim danima po hektaru, procenjena je na minimum 95 radnih dana/ha za održavanje plantaže, transport i druge pomoćne zadatke, i na 50 kg/radni dan za berbu voća. Ove procene su izvedene iz različitih izvora predstavljenih u Tabeli 2, kao i iz konsultacija sa stručnjacima iz savetodavnih službi u Beogradu, Kraljevu, Užicu, Valjevu i Čačku. Utvrđeno je da se dnevne stope plata razlikuju u zavisnosti od vrste poljoprivredne operacije i geografske lokacije gazdinstva. Procena porodičnog rada zasnivala se na stopi plata koju je gazdinstvo plaćalo spoljnim radnicima za odgovarajuću operaciju. U slučajevima kada nije bila zaposlena spoljna radna snaga za određeni zadatak, prosečna dnevna stopa plata spoljne radne snage na tom gazdinstvu usvojena je kao osnova za procenu.

Učinak proizvodnje maline u velikoj meri zavisi od dostupnosti i kompetentnosti kvalifikovane radne snage. Shodno tome, neophodna je sveobuhvatna procena iskorišćenja radne snage i povezanih troškova. Poslovi se generalno obavljaju kombinacijom angažovanih spoljnih radnika i neplaćenog porodičnog rada, pri čemu svaki od njih ima različite ekonomske efekte na celokupni proizvodni sistem. U tabeli 3 prikazan je obim angažovanja spoljnih radnika po pojedinim radnim operacijama.

Analiza u okviru istraživanja je pokazala da u 2024. godini spoljna angažovana radna snaga nije bila zaposlena u svim radnim operacijama na anketiranim gazdinstvima, sa jednim izuzetkom berbe maline. Konkretno, spoljni radnici su bili angažovani na 109 gazdinstava za obradu zemljišta, 85 za đubrenje, 146 za uklanjanje mladih izdanaka, 110 za orezivanje i uklanjanje starih izdanaka i 74 za primenu mera zaštite biljaka. Berba maline bila je jedina ručna aktivnost koja se dosledno obavljala uz pomoć spoljne radne snage na svakom gazdinstvu u uzorku. Štaviše, berba je činila najveći prosečan nivo angažovanja spoljne radne snage. Kao što je prikazano u Tabeli 3, uloženi spoljni radni angažman u 2024. godini značajno je varirao među gazdinstvima. Prosečan uloženi spoljni radni angažman iznosio je 174,7 radnih dana po hektaru.

Operacije prskanja mogu se obavljati ručno ili pomoću mehanizovane opreme. Troškovi koji nastaju angažovanjem spoljnih mehanizovanih usluga klasifikuju se kao troškovi spoljnih mehanizovanih usluga. Nasuprot tome, količina i troškovi spoljne radne snage uključene u ručno prskanje dokumentuju se odvojeno u okviru evidencije o utrošenom radu. U tabeli 4 prikazan je utrošak i struktura utroška rada po pojedinim radnim operacijama prema istraživanju i obračunu autora.

Tabela 3. Obim eksterno angažovane radne snage (radni dan/ha)

Indikator / radna operacija	Kultivacija zemljišta	Đubrenje	Orezivanje mladih izdanaka	Orezivanje starih izdanaka	Berba	Prskanje
Broj gazdinstava*	109	85	146	110	174	74
Minimalni utrošak rada** (radni dan/ha)	2.00	1.30	1.90	1.30	5.30	1.10
Maksimalan utrošak rada (radni dan/ha)	35.00	26.70	80.00	50.00	366.70	20.00
Prosečan utrošak rada (radni dan/ha)	6.50	4.70	16.70	8.10	135.20	3.50
Normativ utroška rada (radni dan/ha)	20.00	9.00	20.00	10.00	50*** kg/dan	6.00

Izvor: Čanak i Tomić, 2025.

Legenda: *broj gazdinstava koje su angažovale spoljnu radnu snagu za određenu radnu operaciju; **za gazdinstva koje su angažovale spoljnu radnu snagu; ***produktivnost ručnog branja

Iz Tabele 4 može se videti da ukupna potreba za radnom snagom iznosi 106,9 radnih dana po hektaru za sve operacije, osim berbe. To uključuje poslove održavanja voćnjaka i pomoćne aktivnosti. Ovaj rezultat je u velikoj meri zasnovan na usvojenoj metodologiji za procenu porodičnog ulaganja rada i stoga je otvoren za diskusiju. Ipak, izračunata potreba od 106,9 radnih dana po hektaru može se smatrati da je u okviru realno dostižnih vrednosti. Relativni značaj ulaganja rada za održavanje voćnjaka i pomoćne aktivnosti čini 33,4% ukupne potrebe za radnom snagom. Ulaganje rada za berbu voća čini 66,6% ukupnog ulaganja rada, pri čemu spoljna radna snaga doprinosi 210 radnih dana po hektaru, a porodična radna snaga doprinosi 213,5 radnih dana po hektaru.

Tabela 4. Utrošak rada po radnoj operaciji

Radne operacije/ Kategorija rada	Minimalni normativni rad	Spoljna radna snaga		Porodični rad		Ukupan rad	
	radni dan	radni dan	%	radni dan	%	radni dan	%
Kultivacija zemljišta	20	6.6	4	13.9	10	20.5	6.4
Đubrenje	9	4.8	3	6.1	4	10.8	3.4
Orezivanje mladih izdanaka	20	17.0	10	7.5	5	24.5	7.7
Orezivanje starih izdanaka	10	8.1	5	5.3	4	13.4	4.2
Prskanje	6	3.5	2	4.1	3	7.6	2.4
Ostale operacije	30	0.0	0	30.0	21	30.0	9.4
Ukupno – bez berbe	95	40.0	23	66.9	46	106.9	33.4
Berba	210	135.0	77	78.5	54	213.5	66.6
Ukupno utrošen rad	305	175.0	100	145.4	100	320.4	100

Izvor: Obracun autora

U 2024. godini, dnevnice isplaćene spoljno angažovanim radnicima na anketiranim gazdinstvima pokazale su značajne varijacije, kako među različitim poljoprivrednim operacijama, tako i među pojedinačnim gazdinstvima. U narednoj tabeli su prikazane jedinične cene radnih operacija ekterno angažovane radne snage u 2024.godini u proizvodnji maline.

Tabela 5. Jedinične cene radnih operacija koje obavlja eksterno angažovana radna snaga u 2024.godini (€/radni dan)

Indikator/ Operacija	Kultivacija zemljišta	Đubrenje u redu	Orezivanje mladih izdanaka	Orezivanje starih izdanaka	Berba	Prskanje
Najniža cena (€/radni dan)	25.60	25.60	25.60	25.60	25.60	25.60
Najviša cena (€/radni dan)	42.66	42.66	51.19	51.19	59.73	42.66
Prosečna cena (€/radni dan)	40.10	40.93	40.39	40.67	42.07	41.36

Izvor: Čanak i Tomić, 2025.

Prilikom izračunavanja troškova porodičnog rada, ulozi porodičnog rada za svaku operaciju vrednovani su po stopama zarada isplaćenim spoljno angažovanim radnicima. Ulozi rada za ostale operacije (30 radnih dana/ha) procenjeni su korišćenjem prosečne stope zarade spoljno angažovane radne snage na odgovarajućem gazdinstvu. U narednoj tabeli prikazani su troškovi radne snage u 2024. godini u proizvodnji maline po pojedinim radnim operacijama.

Tabela 6. Troškovi radne snage po rednim operacijama u 2024.godini

Radne operacije / Kategorija troškova	Spoljna radna snaga			Porodični rad			Ukupan rad		
	€/ha	€/kg	%	€/ha	€/kg	%	€/ha	€/kg	%
Kultivacija zemljišta	258.2	0.025	35	475.3	0.052	9	733.6	0.077	6.1
Đubrenje	203.6	0.019	3	233.1	0.022	4	436.7	0.041	3.3
Orezivanje mladih izdanaka	689.2	0.065	9	283.1	0.027	5	972.3	0.092	7.3
Orezivanje starih izdanaka	327.9	0.031	4	203.2	0.019	3	531.1	0.050	4.0
Prskanje	150.2	0.014	2	159.1	0.015	3	309.3	0.029	2.3
Ostale operacije	0.0	0.000	0	1254.3	0.119	21	1254.3	0.119	9.4
Ukupno bez berbe	1629.2	0.155	22	2608.2	0.255	45	4237.4	0.410	32.4
Berba	5698.3	0.548	78	3302.9	0.305	55	9001.2	0.854	67.6
Ukupni troškovi rada	7327.4	0.703	100	5911.1	0.560	100	13238.5	1.263	100

Izvor: Obračun autora

U 2024. godini, prosečni troškovi eksterno angažovane radne snage za održavanje voćnjaka i pomoćne poslove iznosili su 1.629,2 evra po hektaru, ili 0,155 evra po kilogramu, što predstavlja 22% ukupnih eksternih troškova rada. Odgovarajući prosečni troškovi porodičnog rada za iste aktivnosti iznosili su 2.608,2 evra po hektaru, ili 0,255 evra po kilogramu, što čini 45%. Zajedno, ovi rashodi su iznosili 4.237,4 evra po hektaru, ili 0,41 evra po kilogramu, što predstavlja 32,4% ukupnih troškova ručnog rada.

Troškovi spoljno angažovane radne snage ručne berbe iznosili su 5.698,3 evra po hektaru, ili 0,55 evra po kilogramu, što predstavlja 78% spoljašnjeg ulaganja rada. Troškovi porodičnog rada za berbu voća procenjeni su na 3.302,9 evra po hektaru, ili 0,305 evra po kilogramu, što čini 55% porodičnog ulaganja rada.

Prethodna analiza ističe značaj troškova berbe maline, kojima je potrebna posebna pažnja. Ukupni troškovi spoljne radne snage iznosili su 7.327,4 evra po hektaru, ili 0,703 evra po kilogramu, dok su procenjeni troškovi porodične radne snage bili 5.911,1 evra po hektaru, ili 0,56 evra po kilogramu. Ukupni troškovi rada iznose ukupno 13.238,5 evra po hektaru, ili 1,263 evra po kilogramu.

3 Zaključak

Analiza troškova radne snage u proizvodnji maline na odabranim poljoprivrednim gazdinstvima u Srbiji u 2024. godini pokazuje dominantnu ulogu ljudskog rada u određivanju ukupne ekonomičnosti proizvodnje. Na 174 gazdinstva koja obrađuju 101,12 hektara, postignuti su prinosi od preko milion kilograma maline sorte Vilamet, što je generisalo prihode veće od 2,26 miliona evra. Prosečan učinak gazdinstva dostigao je 10.501 kg/ha i 22.403 evra/ha prihoda, isključujući subvencije. Utrošak rada je iznosio 320,4 radnih dana po hektaru, a ukupni troškovi rada procenjeni su na 13.238,5 evra/ha ili 1,263 evra/kg. Od svih radnih operacija u proizvodnji maline, berba je bila radno najintenzivnija operacija, koja je činila 66,6% ukupnog uloženog rada, pri čemu su spoljno angažovani radnici doprinosili sa 210 radnih dana/ha, a porodični radnici sa 213,5 radnih dana/ha. Održavanje voćnjaka i pomoćni poslovi zahtevali su 106,9 radnih dana/ha, što predstavlja 33,4% ukupnog uloženog rada. Analiza troškova je pokazala da je prosečan trošak spoljno angažovane radne snage iznosio 0,703 evra/kg, dok su troškovi porodičnog rada bili 0,56 evra/kg, što zajedno čini 1,263 evra/kg. Indikatori produktivnosti su pokazali da je svaki radni dan angažovane radne snage dao 32,78 kg maline i generisao 69,92 evra prihoda. Za svaki uloženi evro rada gazdinstva su ostvarila prihod od 1,69 evra, što ističe ekonomski značaj efikasne raspodele rada.

Zahvalnica

Istraživanje je urađeno u okviru Ugovora o sprovođenju i finansiranju naučnih istraživanja u 2025. godini između Instituta za primenu nauke u poljoprivredi i Ministarstva za nauku, tehnološki razvoj i inovacije Republike Srbije, br. 451-03-136/2025-03/200045.

Izjava o sukobu interesa

Autori izjavljuju da ne postoji sukob interesa.

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ANALYSIS OF MANUAL LABOR COSTS ON SELECTED RASPBERRY FARMS IN SERBIA IN THE 2024 PRODUCTION YEAR

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Summary

This study examines the role and cost structure of manual labor in raspberry production on selected Serbian farms during the 2024 season. A sample of 174 holdings cultivating 101.12 hectares of Willamette raspberries yielded 1,061,907 kilograms, generating revenues of €2.27 million. Average farm size was 0.58 hectares, with yields of 10,501 kg/ha and revenues of €22,403/ha. Labor input totaled 320.4 workdays per hectare, with associated costs of €13,238.5/ha or €1.263/kg. Harvesting was the most labor-intensive operation, accounting for 66.6% of total labor input, while orchard maintenance and auxiliary tasks represented 33.4%. External labor costs averaged €0.703/kg, and family labor costs €0.56/kg. Productivity indicators showed that each workday produced 32.78 kg of raspberries and €69.92 in revenue, with every €1 invested in labor generating €1.69 in revenue. The findings underscore the critical importance of labor efficiency in sustaining profitability within labor-intensive fruit production systems.

Keywords: *raspberry production, manual labor costs, small farms profitability, Willamette.*

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1 Introduction

Raspberry represents one of the most important fruit crops in Serbia and has great economic importance for domestic agriculture and export. Serbia is one of the largest producers of raspberries on the international market, along with Poland, Chile and Mexico. Raspberry production is very important both in terms of export revenue and rural employment (Milosavljević et al., 2025). Raspberry production in Serbia is mainly concentrated in the area of western and central Serbia, namely Arilje, Požega, Kosjerić, Bajina Bašta, Užice in the Zlatibor region, as well as Ivanjice, Čačak and Lučani in the Moravian region. The most represented variety is Willamette, which is valued for its quality, and the Meeker and Polka varieties also play an important role. Raspberry production in Serbia varies depending on climatic conditions, yield and other factors and in recent decades has ranged between 80,000 and 100,000 tons per year, and the area under raspberries in Serbia ranges between 15,000 and 20,000 hectares. In Serbia, raspberries account for a significant share of agricultural exports, providing vital income to thousands of smallholder households. Most of the produced raspberries are exported in a frozen state to the markets of the European Union, primarily Germany, France and Austria.

However, the sector faces persistent challenges, particularly those related to volatile prices, rising input costs, and a high dependence on seasonal and family labor (Milosavljević et al., 2025). Raspberry production requires a significant manual labor, which is why it is considered one of the most intensive branches of fruit production. In recent years, the problem of labor shortage in Serbia in the berry fruit production sector has become increasingly apparent, primarily due to difficult working conditions, seasonal nature of employment and population migration from rural areas, which is reflected in the economic results and the quality of the product and the timeliness of the harvest. In addition to seasonal workers, the work of members of family farms also plays a significant role in the production of raspberries. Further, price instability remains one of the most pressing risks for raspberry producers. Raspberry prices are influenced by international demand, climatic shocks, and global supply competition. Consequently, profitability of raspberry production in Serbia is highly uncertain, and smallholder farmers often lack tools to anticipate market shifts (Milosavljević et al., 2025).

In the paper, the authors analyze the importance and structure of labor costs in raspberry production on selected farms in Serbia during the 2024 season. The primary objective of this study is to adapt existing labor input standards from the literature into a methodological framework for estimating both the volume of family labor and its imputed cost on selected agricultural holdings. This approach aims to enhance the accuracy of total manual labor cost assessments and, ultimately, the overall cost of raspberry production. A secondary objective is to apply this framework to calculate manual labor costs in raspberry production on selected family farms in Serbia during 2024.

This research is part of bigger research about profitability of raspberry production in Serbia.

2 Material and Methods

The database of the Institute for the Application of Science in Agriculture used in this research was constructed from a group of agricultural farms whose primary economic activity is raspberry cultivation (hereinafter referred to as “selected family holdings”). These farms were identified in accordance with the provisions of the Rulebook on the Methodology for Conducting Advisory Services in Agriculture (Official Gazette of the Republic of Serbia, No. 65/2014), which forms an integral part of the Regulation on the Annual Program for the Development of Agricultural Advisory Services, adopted separately for each calendar year.

The 2024 raspberry production database encompasses 223 selected agricultural holdings in Serbia cultivating eight different raspberry varieties: Willamette (192), Polka (13), Polana (6), Enrosadira (4), Glen Ample (3), Fertodi Zamatos (2), Meeker (2), and Tulameen (1). Of the 192 holdings cultivating the Willamette variety, 181 conducted production within a conventional open-field system. After excluding seven holdings with incomplete data, the final sample comprised 174 agricultural holdings used for subsequent analysis.

The database for the raspberry production line contains primary data on external labor inputs and the corresponding daily wage payments for the following manual operations: soil cultivation, fertilization, pruning and removal of young canes, pruning and removal of old canes, harvesting, and spraying. These collected data represent expenditures for specific labor operations during the 2024 production year.

Such a questionnaire structure is uniform across all fruit production lines within the data collection software. In addition to the aforementioned manual operations, there are other tasks as well, both for orchard maintenance and for auxiliary activities. Labor inputs for operations such as tying canes and tightening wires, irrigation, and preparation of protective solutions are estimated and included under other family labor costs.

It is important to note that, in practice, family labor is also engaged in activities such as procurement of production materials, transportation of workers and harvested fruit, field inspections, and similar tasks. Labor inputs for these activities are rarely assessed individually; instead, a consolidated estimate is typically adopted. Estimation of family labor input for these activities is also included under other family labor costs.

The estimation of family labor input by individual operations was based on established data from professional literature. A key characteristic of the selected farms is that they were chosen specifically for their extensive application of recommended

pomotechnical practices, which also qualifies them as demonstration farms. As a result, these farms achieve significantly higher yields compared to the national average in Serbia-often exceeding it by more than 100%.

Family labor costs represent a crucial component of total agricultural production expenses, yet they are frequently overlooked. Common approaches to their evaluation include the market wage substitution method (Picazo-Tadeo et al., 2005) and the opportunity cost method (Rosenzweig & Udry, 2014). Both approaches estimate the value of family labor by applying prevailing local wage rates to the hours contributed by household members, effectively treating them as if they were hired workers.

Estimating the input of family labor is not always a straightforward task. A major challenge lies in the fact that farmers typically do not maintain systematic records of family labor utilization. Furthermore, even within the same raspberry cultivar and production system, labor requirements for individual operations can vary significantly. These discrepancies may be substantial not only between different farms within the same production year but also within a single farm across different years.

Drawing on literature sources and consultations with experts from Serbia's Agricultural Advisory Services, as well as with producers themselves, labor input estimates were derived for specific operations. The term standardized labor input was adopted to describe these operation-specific estimates. It is important to note that these standardized inputs refer exclusively to the 2024 production year and should be considered as averaged approximations.

For all operations where the input of externally hired labor was equal to or greater than the standardized input, the family labor input was estimated as zero. Conversely, for operations where the external labor input was lower than the standardized value, the family labor input was estimated as the difference between the standardized input and the external labor input.

3 Results and Discussion

The sample encompassed 174 selected agricultural holdings, which in 2024 produced a total of 1,061,907.00 kilograms of raspberries and generated a revenue of 2,265,366.77 €. Table 1 shows structure of mentioned raspberries production results in Serbia in 2024.

Table 1. Raspberries production results in 2024

Value / Indicator	Area (ha)	Yield (kg/ha)	Income (€/ha)
Minimum	0.15	3,000.00	5,122.08
Maximum	2.50	27,000.00	57,623.36
Average	0.58	10,501.45	22,402.76
Total	101.12	1,061,907.00*	2,265,366.77**

Source: modified according to Čanak & Tomić, 2025. Legend: *in kg, **in€

The achieved results were obtained through the investment of specific production factors, among which manual labor proved to be the most significant. Based on an analysis of variable costs within the same sample (Čanak & Tomić, 2025), it was shown that labor costs accounted for 90% (€1.26/kg) of the total variable costs (€1.40/kg). The authors argue that in production lines largely dependent on human labor, a more detailed examination of labor inputs and labor costs is essential. Table 2 shows the labor input per working operations in raspberry production according to various sources of literature and research.

Table 2. Labor input per working operation

Spreading of manure (w.day; h*)	Spreading of mineral fertilizers (w.day; h*)	Binding of shoots and tensioning of the wire (w.day; h*)	Pruning of young shoots (3x) (w.day; h*)	Pruning and removal of old shoots (w.day; h*)	Manual hoeing in rows (w.day; h*)	Irrigation (w.day)	Harvest (kg/w.day; kg/h*)	Preparation of protection solution (w.day)	Other works (w.day)	Total (w.day) – without picking	Reference
5	4	20	20	20	20	-	50	3	4	96	Milinković et.al, 2005
5	4	20	20	10	20	-	40	-	-	79	Veljković et al., 2006
-	-	800 - 1100*			300 - 400*		4*	-	-	1100 - 1500*	Apáti, F., 2014*
6	3	30	20	15	20	-	48	-	-	94	Lukić et al., 2015
5	5	5	10	10	20	50	56,4	-	-	105	Kljajić et al., 2017
-	-	-	-	-	-	-	50-60	-	-	-	Veljković et al., 2019

Source: Author's presentation. Legend: *in working hours

From the above table, it can be observed that labor requirements excluding harvesting are estimated between 79 workdays per hectare (Veljković et al., 2006) and 150 workdays per hectare, assuming a 10-hour workday or 187.5 workdays per hectare assuming a 8-hour workday (Apati, 2014). Harvesting productivity ranges between 40 kg/workday and 60 kg/workday, depending both on the skill of the picker and on yield levels. If an average harvesting productivity of 50 kg/workday is adopted, the labor requirement at a yield of 10 t/ha amounts to 200 workdays per hectare. Field research (survey 2025) indicated that average harvesting productivity over the past decade has ranged between 35 kg/workday and 65 kg/workday in most of the situations.

Family labor input was determined by subtracting the number of external workdays from the total workdays for each individual operation. The overall labor requirement, expressed in workdays per hectare, was estimated at a minimum of 95 workdays/ha for plantation maintenance, transportation, and other ancillary tasks, and at 50 kg/workday for fruit harvesting. These estimates were derived from various sources presented in Table 2, as well as from consultations with experts from state-funded advisory services in Belgrade, Kraljevo, Užice, Valjevo, and Čačak. Daily wage rates were found to vary according to both the type of agricultural operation and the geographical location of the farm. The valuation of family labor was based on the wage rate paid by the farm to external workers for the corresponding operation. In cases where no external labor was employed for a specific task, the average daily wage rate of external labor on that farm was adopted as the basis for valuation.

The performance of raspberry production is largely dependent on the availability and competence of skilled manual labor. Accordingly, a comprehensive assessment of labor utilization and its associated costs is imperative. Manual tasks are generally carried out through a combination of hired external workers and unpaid family labor, each exerting distinct economic effects on the overall production system.

The analysis indicated that in 2024, external labor was not employed across all manual operations on the surveyed farms, with the sole exception of raspberry harvesting. Specifically, external workers were engaged on 109 farms for soil cultivation, 85 for fertilization, 146 for the removal of young shoots, 110 for pruning and removal of old canes, and 74 for the application of plant protection measures. Raspberry harvesting was the only manual activity consistently performed with the assistance of external labor on every farm in the sample. Moreover, harvesting accounted for the highest average level of external labor engagement. As shown in Table 3, external labor inputs in 2024 varied considerably among farms. The average external labor input amounted to 174.7 workdays per hectare.

Table 3. Quantity of externally engaged labor force (w.day/ha)

Indicator/ working operation	Soil cultivation	Fertilization	Pruning of young shoots	Pruning of old shoots	Harvest	Spraying
Number of farms*	109	85	146	110	174	74
Min Labor input** (w.day/ha)	2.00	1.30	1.90	1.30	5.30	1.10
Max Labor input (w.day/ha)	35.00	26.70	80.00	50.00	366.70	20.00
Average Labor input (w.day/ha)	6.50	4.70	16.70	8.10	135.20	3.50
Normative labor input (w.day/ha)	20.00	9.00	20.00	10.00	50*** kg/day	6.00

Source: Čanak & Tomić, 2025.

Legend: *number of farms that hired external labor for a specific work operation;
for farms that hired external labor; *productivity of manual picking

Spraying operations may be carried out manually or using mechanized equipment. Expenditures arising from the engagement of external mechanization services are classified as external mechanization service costs. In contrast, the quantity and cost of external labor involved in manual spraying are documented separately within the labor input records. Table 4 shows the labor input and the structure of labor input pre working operations according to the author's research and calculations.

From Table 4, it can be observed that the total manual labor requirement amounts to 106.9 workdays per hectare for all operations excluding harvesting. These include orchard maintenance tasks and auxiliary activities. This result is largely based on the adopted methodology for estimating family labor input and is therefore open to discussion. Nevertheless, the calculated requirement of 106.9 workdays per hectare can be considered within the range of realistically attainable values. The relative importance of labor input for orchard maintenance and auxiliary activities accounts for 33.4% of the total manual labor requirement. The labor input for fruit harvesting accounts for 66.6% of the total labor input, with external labor contributing 210 workdays per hectare and family labor contributing 213.5 workdays per hectare.

Table 4. Labor input per working operation

Working operation / Labor Category	Minimal Normative Labor	External Labor		Family Labor		Total Labor	
	w.day	w.day	%	w.day	%	w.day	%
Soil cultivation	20	6.6	4	13.9	10	20.5	6.4
Fertilization	9	4.8	3	6.1	4	10.8	3.4
Pruning of young shoots	20	17.0	10	7.5	5	24.5	7.7
Pruning of old shoots	10	8.1	5	5.3	4	13.4	4.2
Spraying	6	3.5	2	4.1	3	7.6	2.4
Other operations	30	0.0	0	30.0	21	30.0	9.4
Total - without harvest	95	40.0	23	66.9	46	106.9	33.4
Harvest	210	135.0	77	78.5	54	213.5	66.6
Total labor input	305	175.0	100	145.4	100	320.4	100.0

Source: Author's calculation

From Table 4, it can be observed that the total manual labor requirement amounts to 106.9 workdays per hectare for all operations excluding harvesting. These include orchard maintenance tasks and auxiliary activities. This result is largely based on the adopted methodology for estimating family labor input and is therefore open to discussion. Nevertheless, the calculated requirement of 106.9 workdays per hectare can be considered within the range of realistically attainable values. The relative importance of labor input for orchard maintenance and auxiliary activities accounts for 33.4% of the total manual labor requirement. The labor input for fruit harvesting accounts for 66.6% of the total labor input, with external labor contributing 210 workdays per hectare and family labor contributing 213.5 workdays per hectare.

In 2024, the daily wage rates paid to external laborers on the surveyed farms displayed substantial variation, both across different agricultural operations and among individual holdings. The following table shows the unit prices of work operations performed by externally hired labor in 2024 in raspberry production.

In calculating the costs of family labor, the inputs of family labor for each operation were valued at the wage rates paid to external workers. Labor inputs for other operations (30 workdays/ha) were assessed using the average wage rate of externally hired labor on the respective farm. The following table shows the costs of manual labor operation in the production of raspberries.

Table 5. Unit prices of work operations performed by externally hired labor in 2024. (€/w.day)

Indicator/ Operation	Soil Cultivation	Fertilization in the row	Pruning of young shoots	Pruning of old shoots	Harvest	Spraying
Lowest price (€/w.day)	25.60	25.60	25.60	25.60	25.60	25.60
Highest price (€/w.day)	42.66	42.66	51.19	51.19	59.73	42.66
Average price (€/w.day)	40.10	40.93	40.39	40.67	42.07	41.36

Source: Čanak & Tomić, 2025.

Table 6. Costs of manual labor operations in 2024.

Working operation/ Cost Category	External Labor			Family Labor			Total Labor		
	€/ha	€/kg	%	€/ha	€/kg	%	€/ha	€/kg	%
Soil cultivation	258.2	0.025	35	475.3	0.052	9	733.6	0.077	6.1
Fertilization	203.6	0.019	3	233.1	0.022	4	436.7	0.041	3.3
Pruning of young shoots	689.2	0.065	9	283.1	0.027	5	972.3	0.092	7.3
Pruning of old shoots	327.9	0.031	4	203.2	0.019	3	531.1	0.050	4.0
Spraying	150.2	0.014	2	159.1	0.015	3	309.3	0.029	2.3
Other operations	0.0	0.000	0	1254.3	0.119	21	1254.3	0.119	9.4
Total - without harvest	1629.2	0.155	22	2608.2	0.255	45	4237.4	0.410	32.4
Harvest	5698.3	0.548	78	3302.9	0.305	55	9001.2	0.854	67.6
Total labor input	7327.4	0.703	100	5911.1	0.560	100	13238.5	1.263	100

Source: Author's calculation

In 2024, the average cost of externally hired labor for orchard maintenance and auxiliary operations was €1,629.2 per hectare, or €0.155 per kilogram, representing 22% of the total external labor costs. The corresponding average cost of family labor for the same activities amounted to €2,608.2 per hectare, or €0.255 per kilogram, accounting for 45%. Combined, these expenditures totaled €4,237.4 per hectare, or €0.41 per kilogram, which represents 32.4% of the overall manual labor costs.

4 Conclusions

The analysis of manual labor costs in raspberry production on selected Serbian farms in 2024 highlights the dominant role of human labor in determining overall production economics. Across 174 holdings cultivating 101.12 hectares, yields of over one million kilograms of Willamette raspberries were achieved, generating revenues exceeding €2.26 million. Average farm performance reached 10,501 kg/ha and €22,403/ha in income, excluding subsidies.

Labor input amounted to 320.4 workdays per hectare, with total labor costs estimated at €13,238.5/ha or €1.263/kg. Harvesting was the most labor-intensive operation, accounting for 66.6% of total labor input, with external workers contributing 210 workdays/ha and family labor 213.5 workdays/ha. Orchard maintenance and auxiliary tasks required 106.9 workdays/ha, representing 33.4% of total labor input.

Cost analysis revealed that external labor averaged €0.703/kg, while family labor costs were €0.56/kg, together forming €1.263/kg. Productivity indicators showed that each workday of manual labor yielded 32.78 kg of raspberries and generated €69.92 in revenue. Importantly, for every €1 invested in labor, farms achieved €1.69 in revenue, underscoring the economic significance of efficient labor allocation.

These findings emphasize that profitability in raspberry production is highly sensitive to labor availability, productivity, and cost management. Future strategies should therefore prioritize optimizing labor inputs, improving harvesting efficiency, and balancing external and family labor contributions to sustain competitiveness in labor-intensive fruit production systems.

Acknowledgement

Research was done under the Contract on the implementation and financing of scientific research in 2025 between the Institute for Science Application in Agriculture and the Ministry of Science, Technological Development and Innovation of the Republic of Serbia, No. 451-03-136/2025-03/ 200045.

Conflict of interests

The authors declare that there is no conflict of interest.

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