

# Optimizing Run Game Performance: YPC Analysis Across Formations and Personnel Packages

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Nathaniel Wright

## **Introduction**

The modern NFL places increasing emphasis on offensive efficiency, with schemes constantly evolving to exploit defensive tendencies. While much attention is given to optimizing passing attacks, a well-designed rushing offense remains a critical component of a balanced, unpredictable attack. Crafting an effective run scheme requires understanding how formation and personnel package decisions influence rushing efficiency across various contexts. This study aims to evaluate the success of different formations and personnel groupings based on yards per carry (YPC) and expected points added (EPA), providing insights into the most effective combinations for maximizing rushing performance. By identifying optimal formations and personnel packages for specific scenarios, offensive play callers can enhance their strategic decision-making, minimize inefficiencies, and create a more dynamic and adaptable rushing attack.

## **Methodology**

This study utilizes a filtered dataset from the `nfl_data_py` database, analyzing all rushing plays from the 2021 through 2024 NFL seasons. This period was selected to provide a robust and contemporary sample size, ensuring findings reflect current offensive and defensive trends. To maintain relevance to typical game conditions, plays were filtered to include only neutral game scripts where the score differential was within two possessions ( $\leq 16$  points). This filtering process ensures that results are not skewed by scenarios where teams abandon the run game due to extreme deficits or attempt to run out the clock with significant leads.

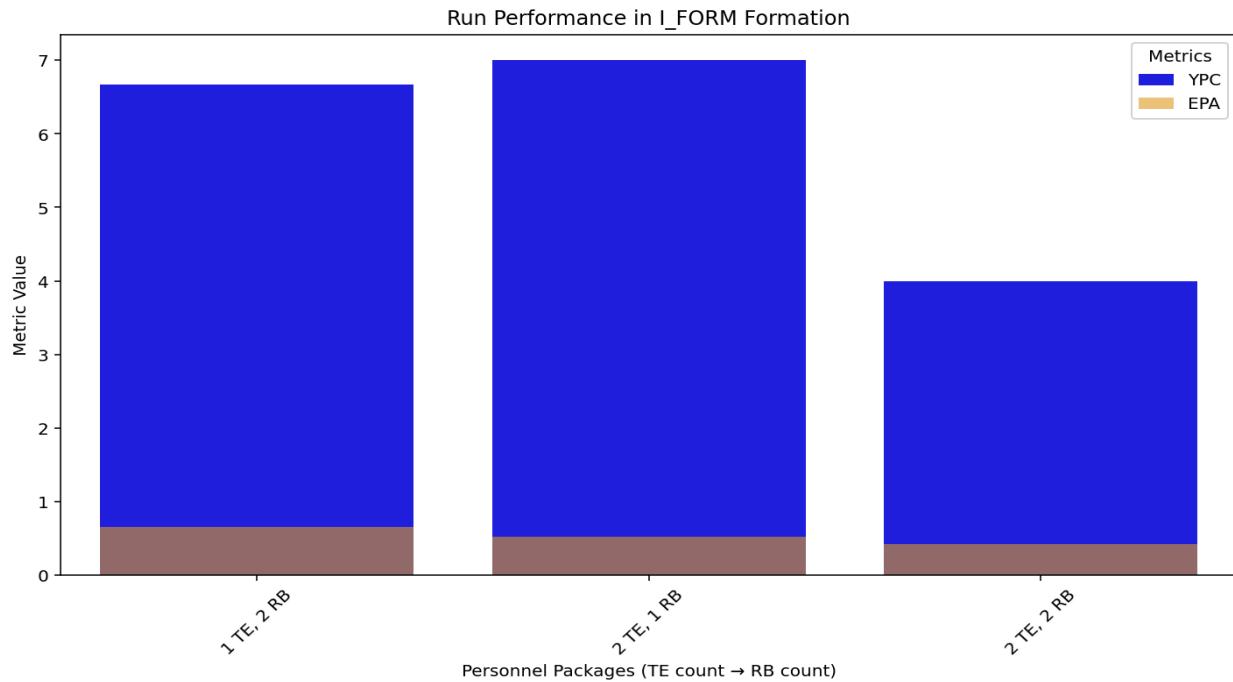
Rushing plays were further categorized by formation (e.g., I-Form, Shotgun, Pistol) and personnel grouping (e.g., 11, 12, 21). For each formation and personnel combination, two primary metrics were calculated: yards per carry (YPC) and expected points added (EPA). These metrics were then aggregated to evaluate the efficiency of different offensive approaches both in isolation and when cross-referenced with other variables.

To enhance the analysis, the study excluded rare or unconventional personnel packages (e.g., 13, 30, 10, and 20 personnel) that might introduce statistical noise due to limited usage. Visualizations were then created to illustrate performance trends across formations and personnel groupings, providing a clear comparison of effectiveness under varying circumstances.

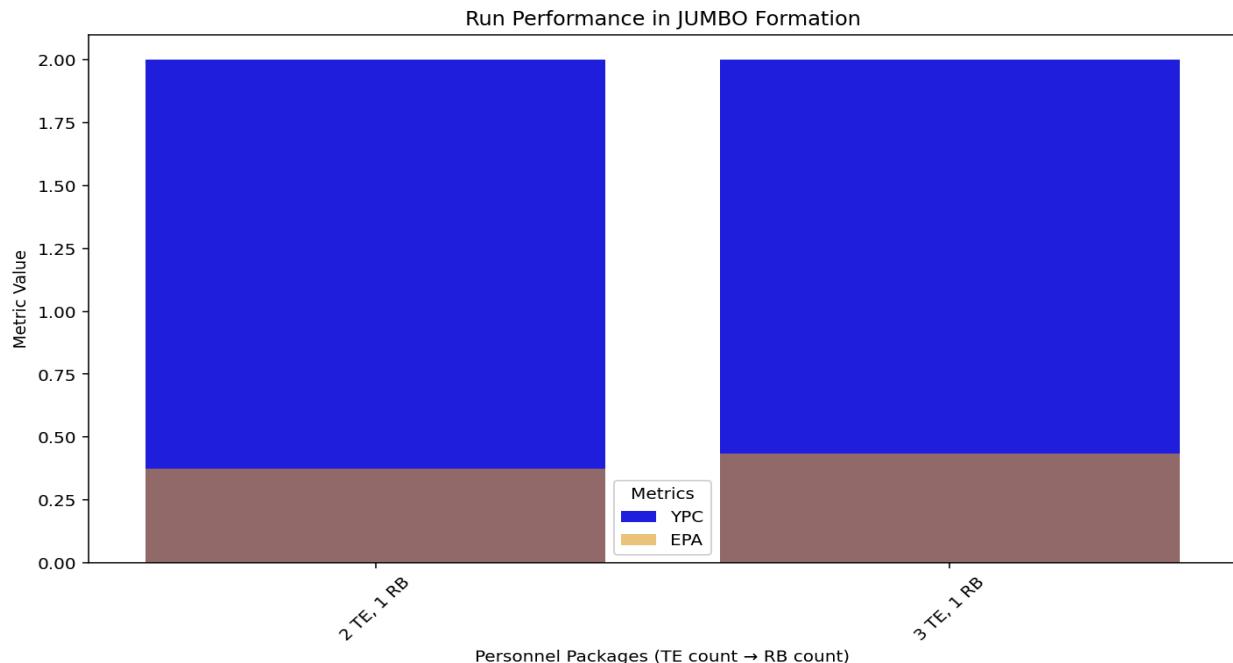
This structured approach aims to uncover actionable insights that can guide offensive play callers in selecting optimal formations and personnel packages to enhance rushing performance.

## Analysis Findings - YPC by Formation and Personnel Groupings

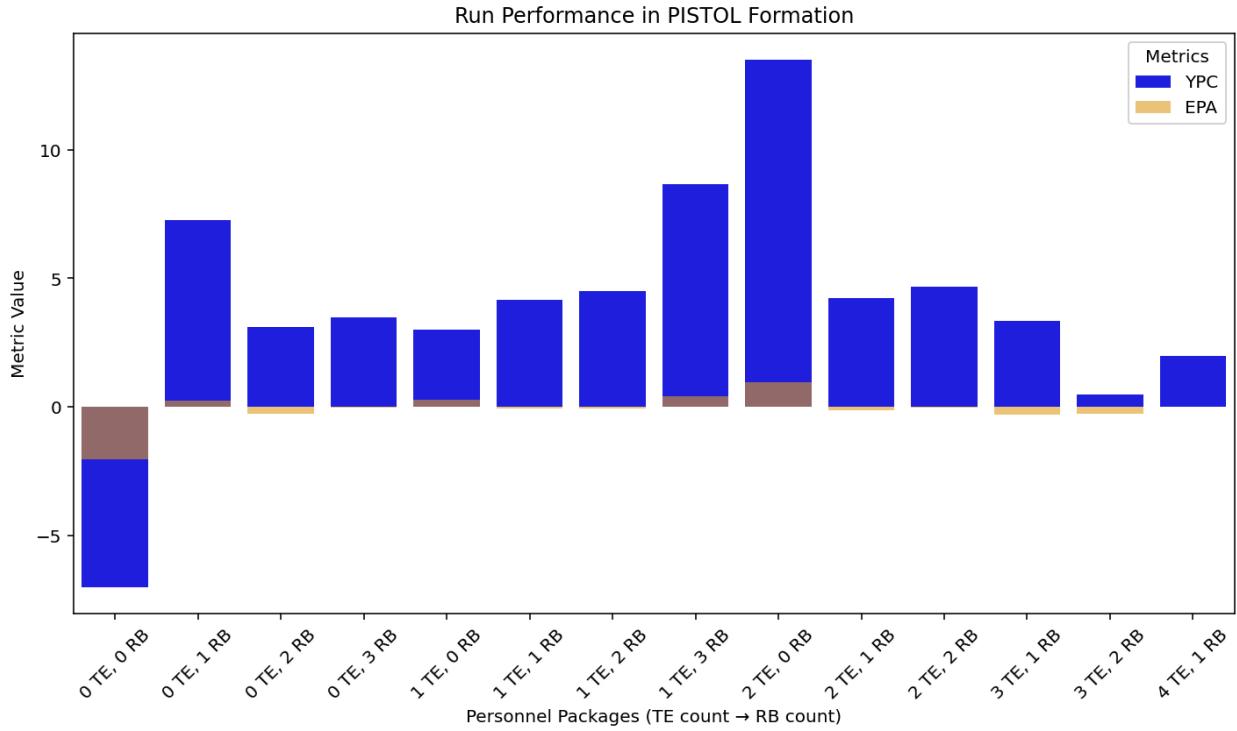
### By Formation:



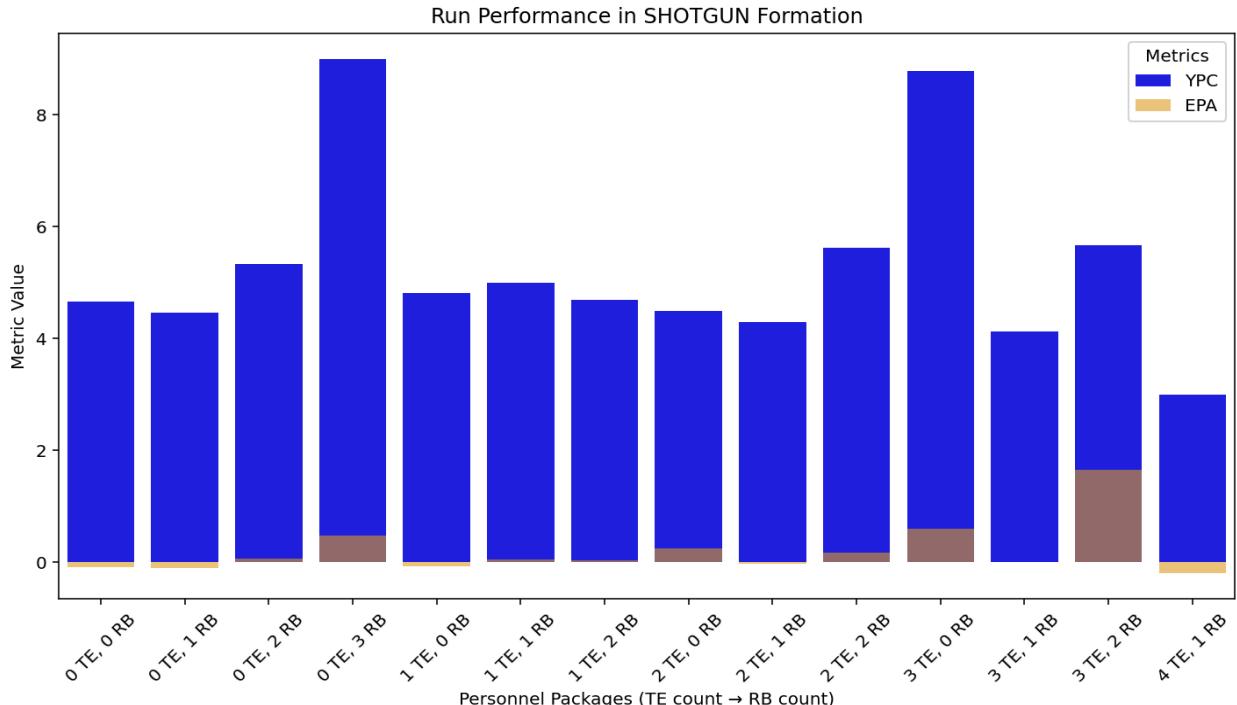
**I-Form:** Highest YPC "traditional" formation (empty has a high ypc but this likely is caused by qb scrambles being logged as runs)... within the formation, **12 & 21 personnel reigns supreme above 22**, showing that **maintaining a semblance of a passing threat opens up the field more** for runs



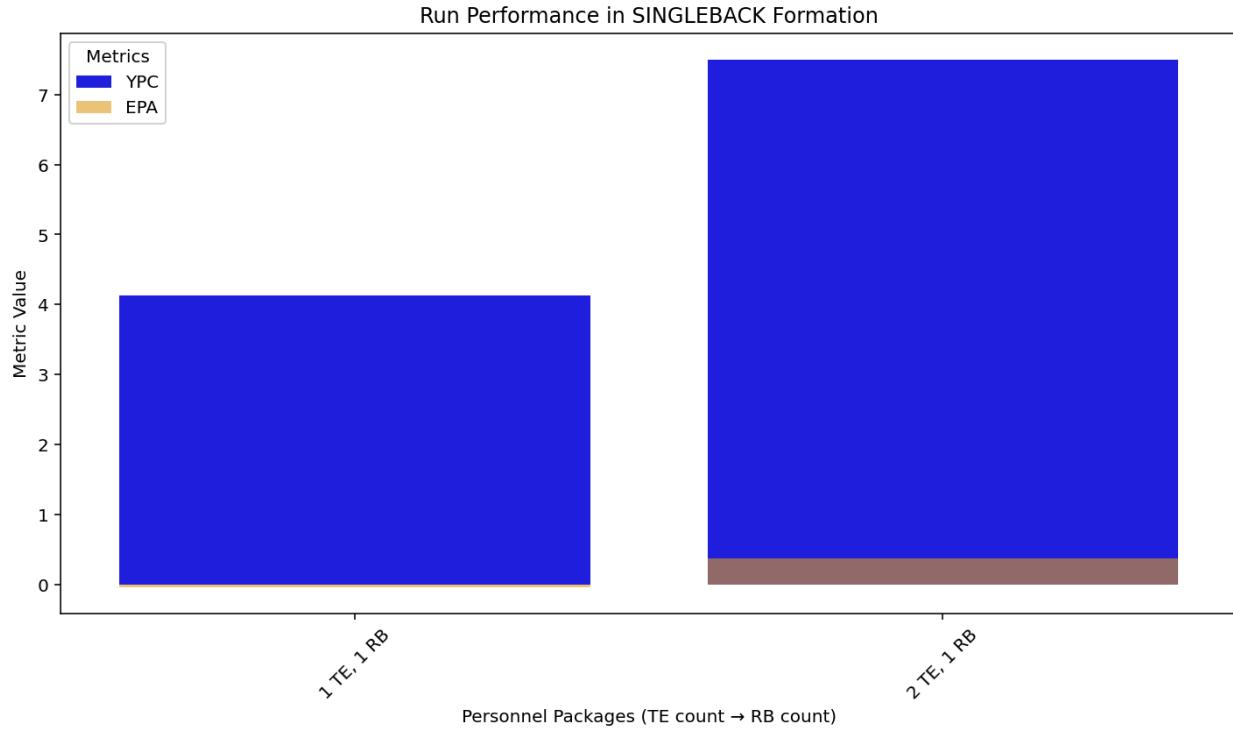
**Jumbo:** As if I need to tell you, **save it only for super short yardage packages** (1 to go or less), you're **better off running out of i form from 2+ yards out** as it presents a passing threat to an extent as mentioned above.



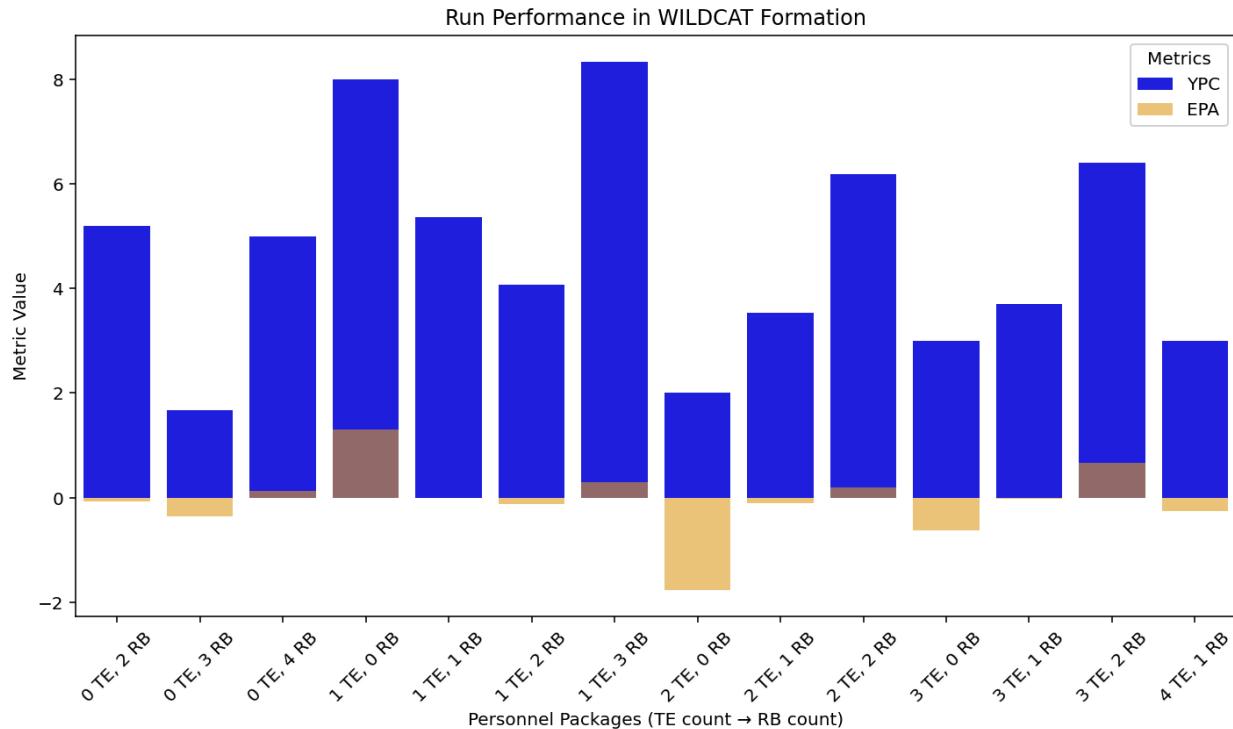
**Pistol:** ignore the 20 personnel, the high number again probably results from qb scrambles, however this does lend to the idea that that might be the best personnel set to implement lateral runs in the form of jet sweeps/pop passes. **As far as traditional runs, full house and 01 personnel (spread/trips formation) stand out.**



**Shotgun:** if you're going to qb run, just send the heavy package out. Normal runs wise, looks as if personnel package doesn't affect things much, so just send out your best guys.



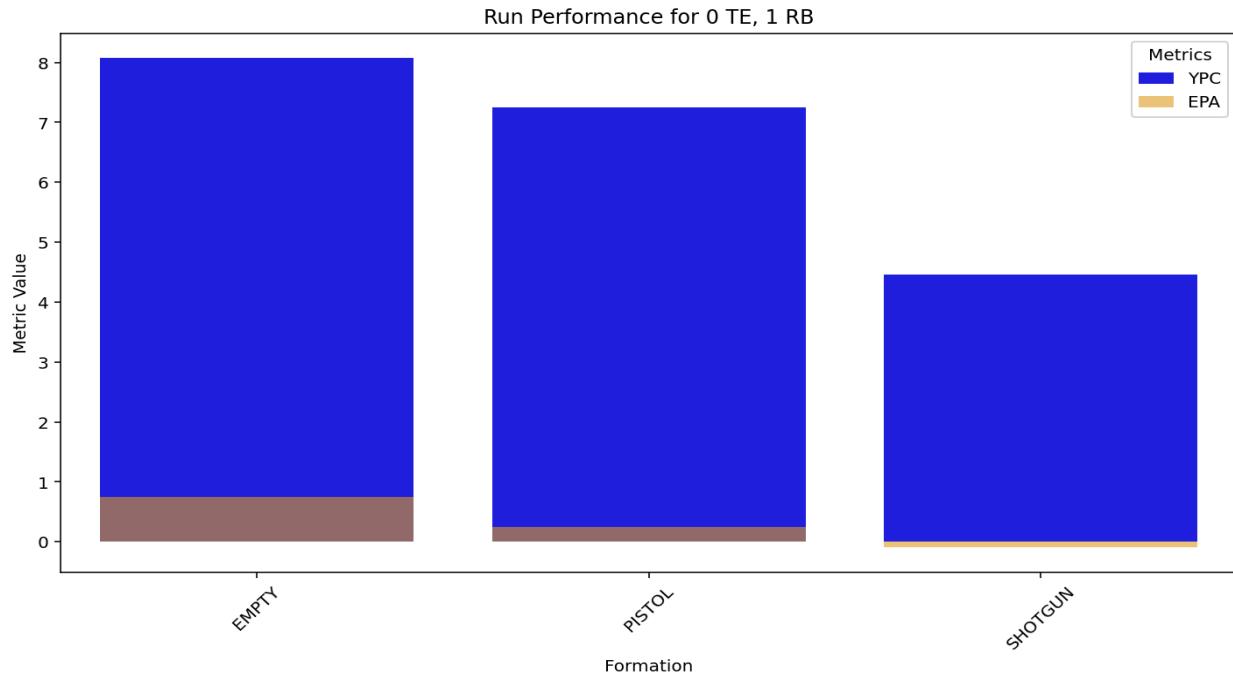
**Singleback:** 21 personnel performs significantly better than 11 personnel, still 4 ypc even with 11 personnel however.



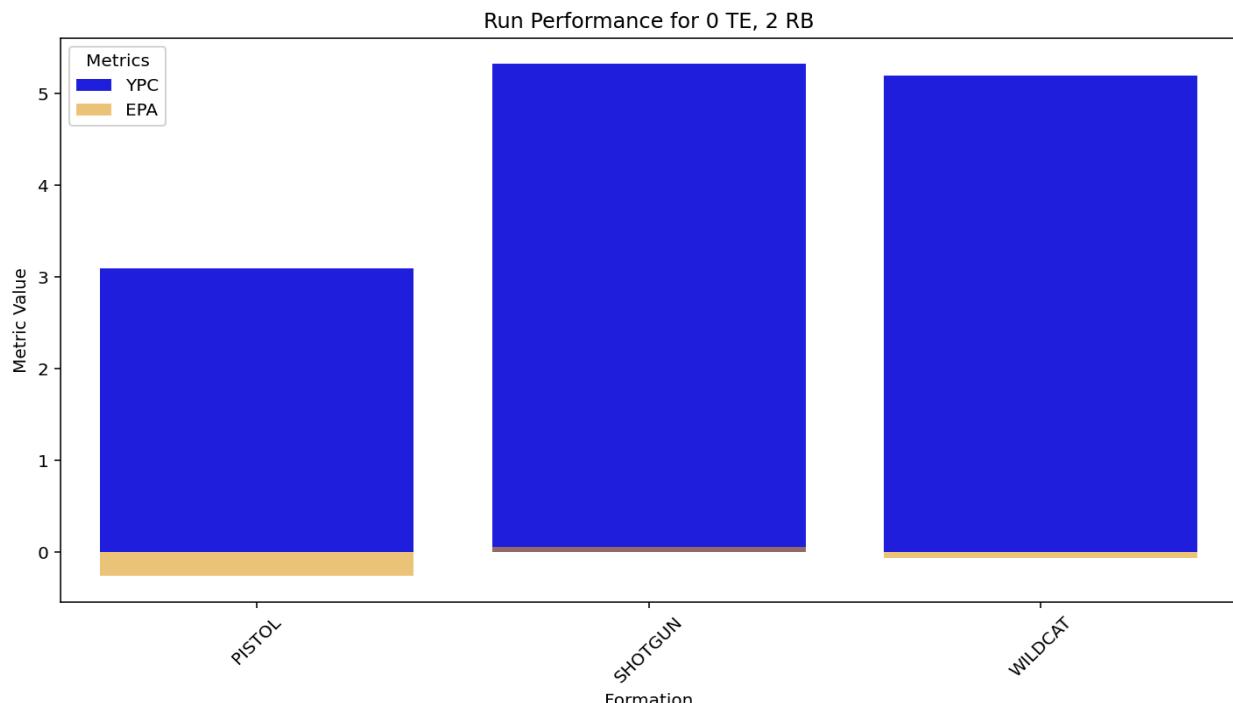
**Wildcat:** Personnel performance is a mess here, seems having **multiple running backs or none at all is better than just one** as the defense likely keys in on the running back on the field when there's only one.

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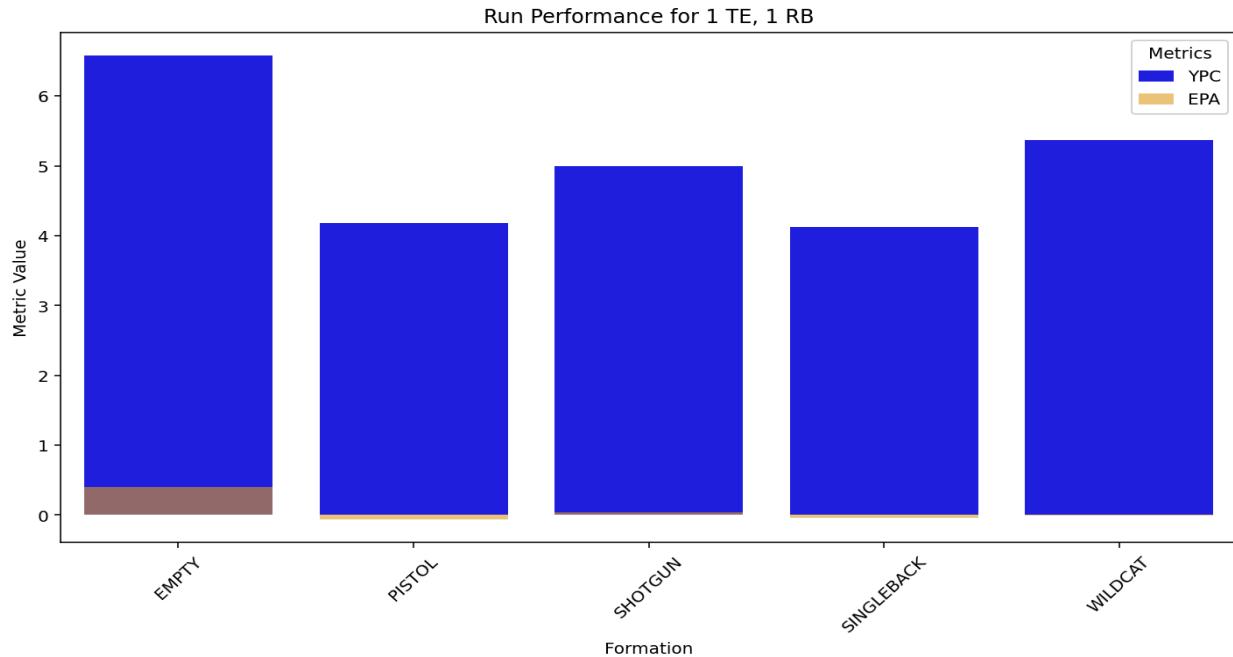
## By Personnel Package:



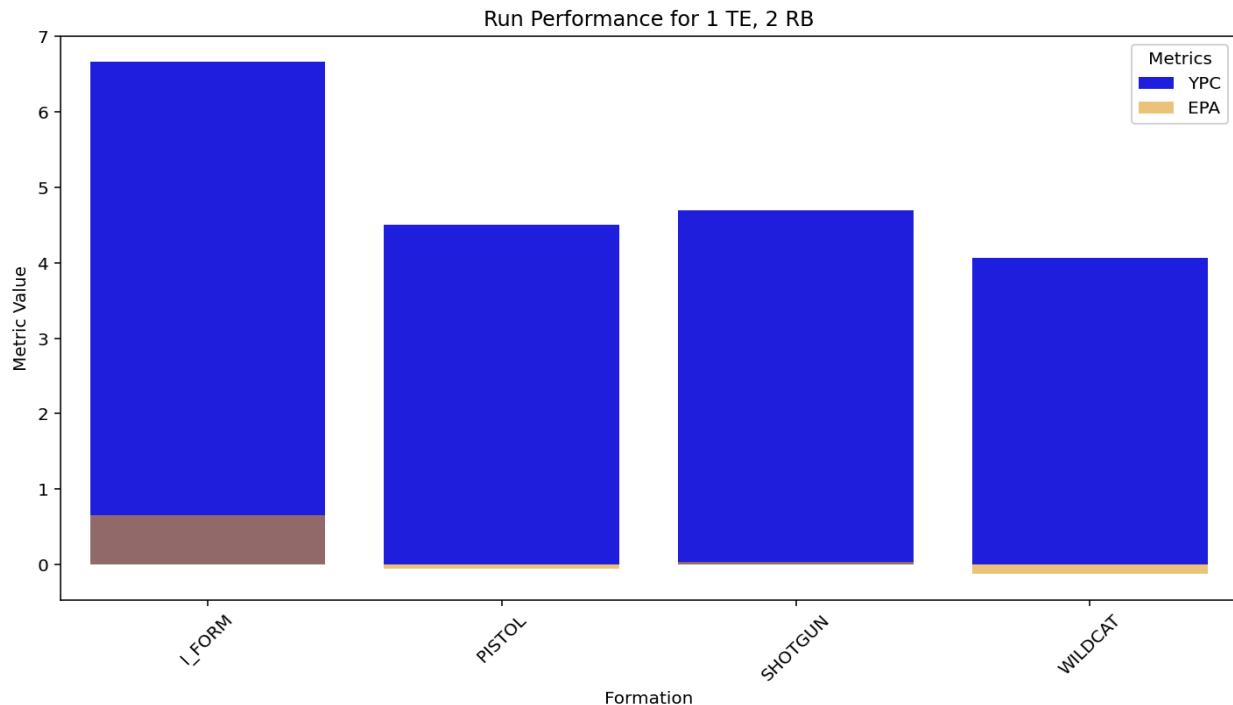
**01:** ignoring empty set, **pistol stands out above shotgun**, likely due to wide receiver blocks not holding for very long, so having the handoff slightly closer to the line of scrimmage allows the back to get in (and hopefully past) the first level before the receiver blocks break and the running back gets momentum going during the handoff. **Quick hitters needed, including your desired cutback and counter plays**, for success out of 01.



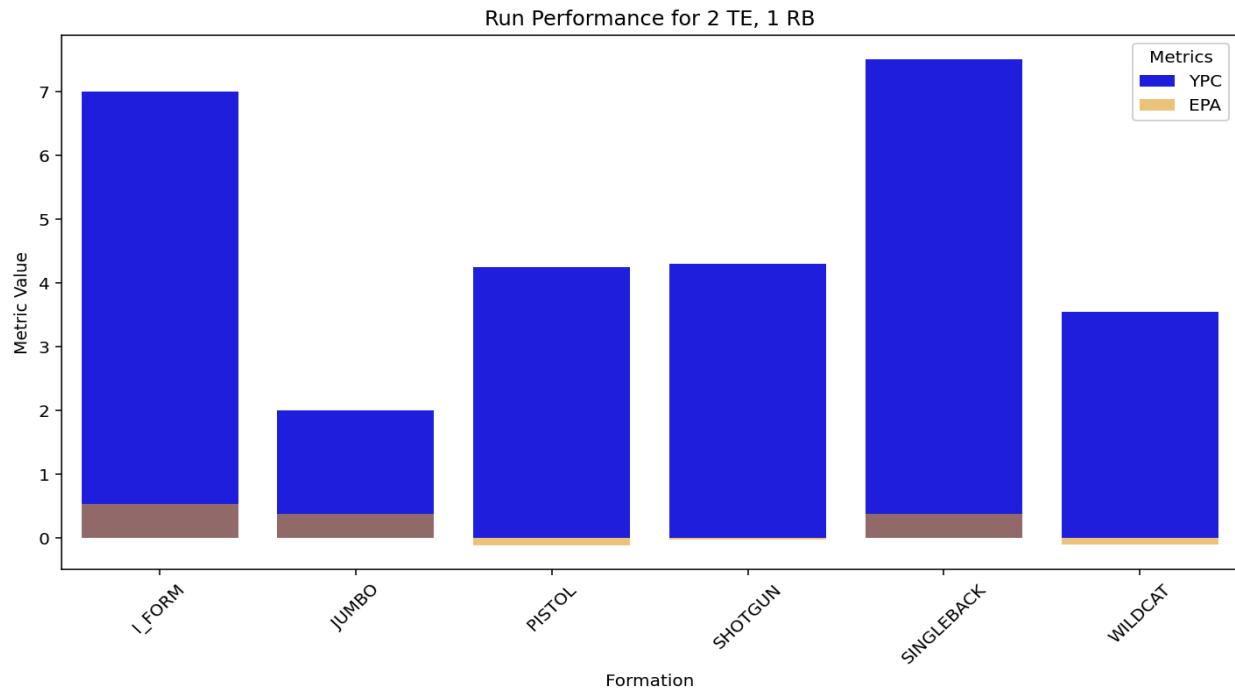
**02:** The opposite of 01, shotgun and wildcat stand out above pistol with 2 running backs. This could probably be attributed to easier lines of sight during option reads from further behind the line, as well as the opportunity for confusion via window dressing and fake handoffs to one of the backs being more visible to the defense. **If you're going to run multi running back option plays, shotgun seems to be the way to go.**



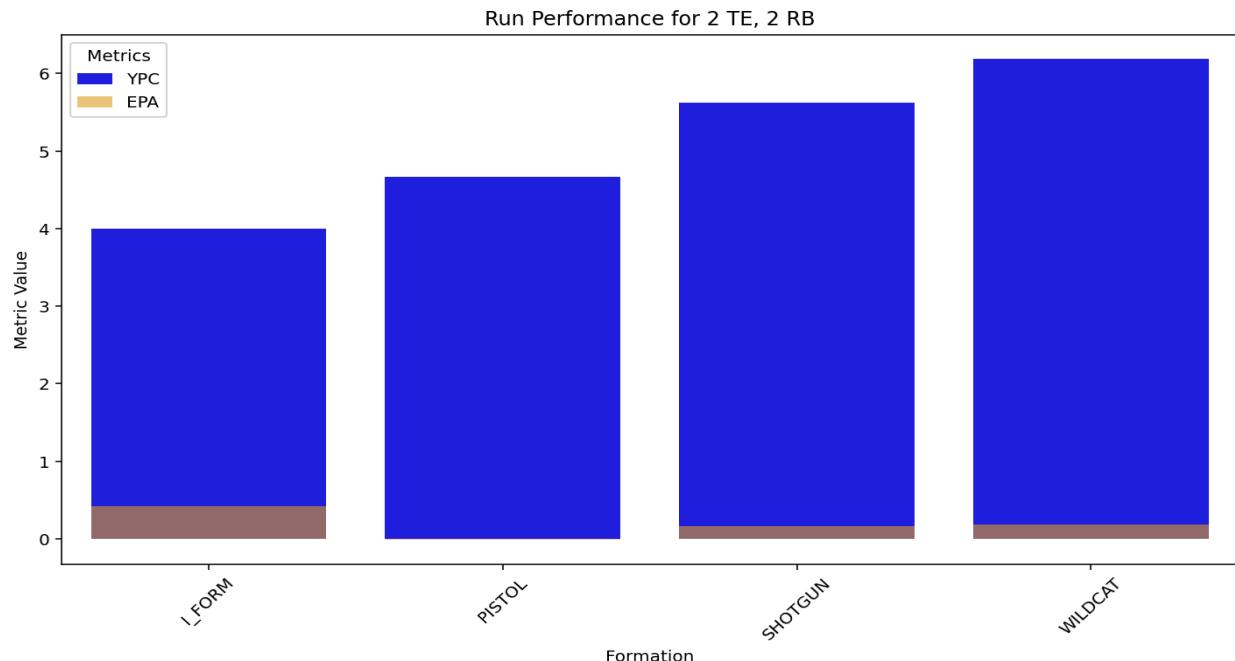
**11:** Running out of shotgun stands above pistol and singleback, this time with the tight end blocking, showing the threat of a pass with 11 personnel in shotgun leads to a higher ypc but ultimately not a huge difference between the main formations with this personnel set, lending to **dealer's choice** so to speak.



**12:** I-form. Simply put, unlike 11 personnel, I form is infinitely better but it is **interesting to note that all base formations with 12 personnel stand out with higher ypc than 11 personnel.** (I would hope so otherwise the second running back isn't doing his job blocking/decoying)



**21:** Singleback and I-form stand out heavily as once you bring in the second tight end, you're better off running from under center as the defense will likely key in on this being a running personnel package.



**22:** Last but least, 22 personnel has all formations out from under center performing above i form. Namely shotgun and wildcat, you will likely need to **get creative if you want to run out of this personnel package.**

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## **Conclusion and Application**

In summary, the analysis reveals that formation and personnel package choices significantly impact run game efficiency. For traditional runs, **I-Form with 12 or 21 personnel** offers the best balance, while **Shotgun** is most effective for **QB runs** when paired with heavier packages. When getting creative, the **Wildcat** is inconsistent, but multi-back or empty sets provide a useful option to confuse defenses as they tend to key in on sets where only a singular back is deployed. **Pistol** works best with **Full House or 01 personnel**, particularly for lateral runs like jet sweeps. **Jumbo** should be reserved for short-yardage situations. Recommendations include prioritizing **I-Form** for downhill runs and using **Shotgun** to maximize spacing and option plays, with a creative approach needed for **22 personnel**.